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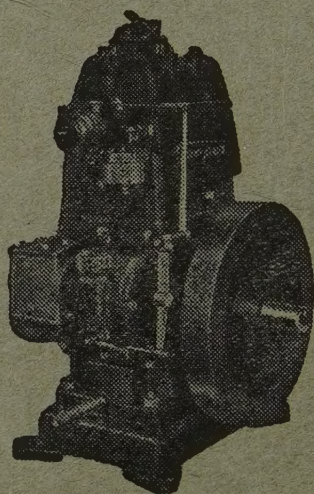
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JOURNAL
OF THE
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OF
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No. 2.

Tobacco Seed-Beds

Their Construction and Management

J. M. ALLAN, Officer-in-Charge, Tobacco Industry

INTRODUCTION

One of the main essentials for the production of a successful tobacco crop is an adequate supply of hardy, well grown, disease-free seedlings. It is also necessary that they should be ready for transplanting at the most suitable time to meet the requirements of land and season. The usual planting-out season in the South-West of Western Australia is from mid-October to the end of November. The dates of transplanting will be governed by seasonal conditions and when the land is dry enough to be prepared for planting. If there is considerable variation in the moisture relations of the land to be planted and the planting-out season is likely to be extended it is advisable to stagger the sowing dates of seed in order that new seedlings are available over the entire period of planting.

Under the cold, wet conditions experienced in the lower South-West of the State during late winter and early spring, it would be impossible to have seedlings ready for planting-out at the right time unless seed-beds were protected from the ill effects of inclement weather, frost and disease. The only satisfactory means of affording such protection is by growing the seedlings in properly constructed, covered seed-beds, well managed and with the use of benzol to prevent infection with disease.

In the pioneer days of growing tobacco in Western Australia, the provisions of sufficient healthy seedling, when required, was one of the most difficult tasks of the tobacco grower. The common practice was to plant large areas of tobacco seed-beds in the open or in sheltered locations, in the hope that sufficient seedlings would survive the adverse conditions and escape disease to enable the area of crop required to be planted. Later, growers developed the practice of having their seedlings raised for them in the metropolitan and other areas that enjoy a milder winter and spring climate than the lower South-West. The main objection to this practice, was that districts selected were mainly the market garden areas in which the eelworm (*Heterodera marioni*) is widely distributed. This nematode is one of the most serious pests of tobacco and is responsible for substantial reductions in yield in tobacco areas in other parts of the world. Eelworm was unknown in Manjimup prior to 1936, and while tobacco seedlings were being brought in from infected areas there was the constant fear that the pest would become widespread in tobacco soils. The nematode made its appearance in several small areas and was only eliminated by abandoning the areas for tobacco growing for quite a number of years. Growers now recognise that the production of seedlings in the open or away from the district is too hazardous, unreliable and a constant source of danger to the industry. Both practices have been abandoned and each grower does his utmost to produce sufficient seedlings for his requirements on his own farm.

The production of tobacco seedlings on the grower's own farm occasions no great difficulty if seed-beds are well constructed and due attention is paid to management. The fungus disease "Downy Mildew," more commonly called "Blue Mould," is widespread in all Australian tobacco areas, and makes it imperative that disease control measures be adopted. The effective method of controlling this disease is by the use of benzol. The type of seed-bed required for the successful use of benzol also meets the requirements for adequate protection of the seedlings against adverse weather conditions, speeds up the growth of the young plants and ensures that suitable seedlings can be ready for when they are required.

AREA OF SEED-BED NECESSARY

The first question for the grower to determine is what area of seed-bed he will require to provide plants for his intended area of crop. To produce vigorous seedlings, the plants should not be grown too thickly in the bed. Up to 1,000 plants per square yard will provide strong seedlings, but if many more than this number are permitted to grow, the plants tend to become weak and spindly. A successful seed-bed should carry 750 to 1,000 plants per square yard.

The number of seedlings required per acre varies according to spacing, from between 5,000 to a little over 7,000. Therefore it might be considered that 10 square yards of seed-bed area would be necessary to plant one acre of tobacco, but it is generally wise to allow a margin over this area, in case some replanting may be necessary due to insect attack, adverse weather conditions during transplanting or other causes. It is suggested that a safe minimum area of seed-bed for each acre of tobacco to be planted would be 12 square yards.

PREPARATION OF THE SEED-BED SITE

Tobacco seed-beds should be established on a well drained soil, preferably on a gentle slope facing the east. They should always be open to the east and to the north to allow maximum sunlight to gain access to the beds. However, it is advantageous if they can be reasonably well sheltered on the southern and western sides to protect them from cold winds.

Although a rich soil is not suitable for the tobacco crop in the field, an originally rich or heavily manured seed-bed soil ensures rapid and vigorous seedling growth. Good drainage is essential and heavy soils that are inclined to form a crust on top are detrimental to seedling growth. In practice sands, light loams or gravelly soils are the most suitable for tobacco seed-beds.

The seed-bed site should be selected in the autumn and either deeply dug over or ploughed as soon as weeds have germinated. The area should subsequently be kept free of all plant growth by frequent cultivation. Clean fallow for two or three months before the establishment of seed-beds sweetens the soil, keeps down weed growth and starves out soil borne insect pests. A sufficient area of land should be cultivated to ensure a strip of bare soil five to six yards wide all around the beds, as this serves to protect them from the invasion of red-legged earth mite and other insect pests from surrounding areas.

CONSTRUCTION OF SEED-BEDS

The seed-beds should be constructed in ample time to allow proper soil preparation before sowing. They are usually made from three feet to four feet six inches in width, although the narrower bed will generally be found more convenient when it comes to weeding, applying benzol and pulling plants. The beds may be made any length, although if very long beds are constructed it is recommended that they be partitioned off in lengths of not more than 20 feet, to avoid the risk of air currents dispersing benzol fumes when used later for the control of "Blue Mould."

It is preferable that the frame surrounding the seed-bed should be made of jarrah boards, although karri timber is quite satisfactory provided it is treated annually with used sump oil or creosote. Face cuts, which can often be obtained cheaply from the sawmills, are quite suitable. Bush timber is not very satisfactory for the purpose.

There are two main designs of seed-bed in use. The best, but more expensive one, is to construct a wooden frame 18 inches high along the back of the bed and nine inches high in front with sloping ends, and divisions where necessary. There are two alternatives for fixing the covers over the beds. One is to construct wooden sashes which are made to fit closely over the top. They are made of 3in. x 1in. timber and for convenience should not exceed 10 feet in length. They can be made, either entirely removable or hinged at the back so that they can be propped open during the day. With hinged sashes it is a good idea to attach a prop about 30 inches long made out of 3in. x 1in. timber across the middle of the sash with a hinge fixed to the front of the sash. In addition to propping up the cover in the open position, the prop can be used for opening and closing the covers from behind the bed.

The covering material is tacked on to these sashes. Figure 1 is a sketch of this type, showing one sash open and part of another closed. Another means of covering, where calico is the material used, is to hem the calico along one side to take a long roller about 2ins. in diameter and to tack the other edge along the outside of the

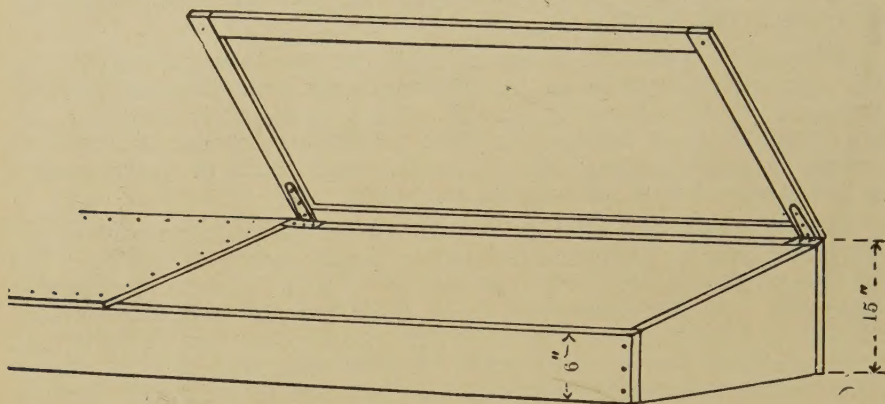


FIG 1

back of the bed. When in position, the roller draws the cover tight over the bed. When it is desired to uncover the bed the cover is rolled up like a blind and allowed to rest on blocks nailed to the outside of the back of the bed as supports. A convenient bed is one 18 feet long by three feet wide. This gives an area of six square yards, sufficient to supply plants for half an acre.

Another type of bed which requires rather less timber, consists of a wooden frame about nine inches high all round the bed. A length of fencing wire is stretched tightly along the centre of the bed and is supported at convenient intervals by short posts. This wire should be at least six inches higher than the top edge of the frame. An alternative to wire is to use a piece of 3in. x 1in. timber let into the end pieces and supported by short posts along the bed. The calico cover is of the roller type with one edge tacked along one side of the frame. It is brought over the wire and then drawn taut by the weight of the roller hanging over the other side of the frame. The ends are filled in with triangular-shaped pieces of timber. When closed this type of seed-bed has the appearance of a rather flat-roofed tent. To uncover, the cover is rolled up like a blind and supported above ground by wooden blocks.

The advantages of sash covers, in preference to the blind type, is that they are more quickly handled, and as the cover is never rolled up, it is less liable to discolouration and mildew.

Unbleached calico is an effective covering material for tobacco seed-beds. A reasonably heavy quality should be used, as with poor quality material, heavy rain is liable to drive through, instead of the water shedding down the slope of the cover. Provided the cover is stretched tight, the slope is steep enough and heavy quality calico is used, there is no necessity for the cover to be water-proofed.

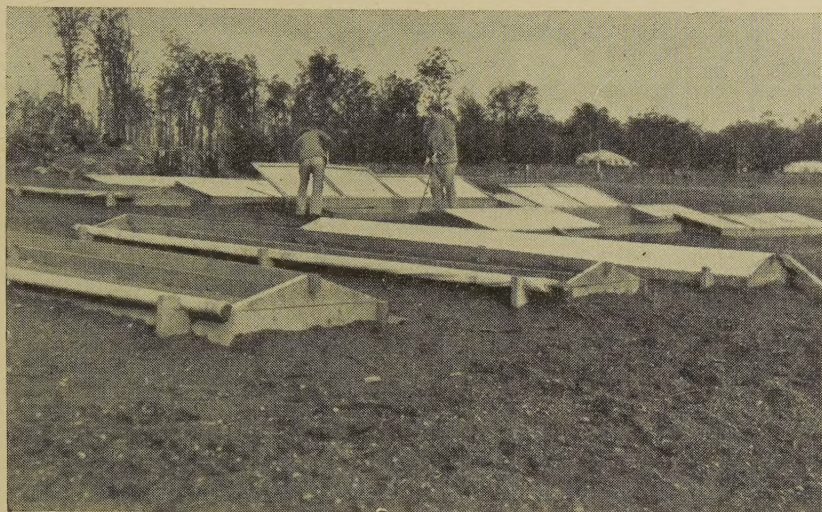


Fig. 2.

Illustration of both types of seed-bed. Sash covered, sloping beds in the background with some sashes open, with both covered and uncovered tent-type beds in the foreground.

(Photo.: T. Bidstrup.)

Experience with water-proofing agents, such as linseed oil, paraffin wax and others, disclosed a tendency to either discolour or rot the fabric and they are not recommended. However, with the constant wetting and drying of the calico on the seed-bed it has a tendency to mildew, which in turn causes rotting and discolouration. With mildew-proofing, the material can be made to last two or more seasons. A proprietary preparation, generally used for this purpose, is "Shirlan WS.." One pound of this substance to 10 gallons of water is the strength recommended. The calico is soaked in this solution until it has become thoroughly wetted, then wrung out lightly and hung out to dry. Allowance should be made for shrinkage if the calico is to be cut before treatment.

Another type of covering material is a proprietary glass substitute known as "Windolite." This material consists of translucent cellulose reinforced by flywire. When used as a seed-bed cover this material cannot be used as a blind. "Windolite" has the property of conserving warmth in the bed to a greater degree than calico, and generally seedlings produced under it are ready for transplanting two or three weeks earlier than those grown under cloth. "Windolite" is much more costly than calico, but if carefully looked after, it should last for at least four or five seasons. When the cost of calico today is taken into account, the longer life of "Windolite," coupled with its advantages may make it the more economical covering material.

Irrespective of which covering material is used, as soon as the seed-bed season is over the covers should be removed from the beds, thoroughly dried and stored in a dry place. The longer calico is left exposed to the elements, the greater tendency it has to perish and discolour. With "Windolite," although it stands up well to conditions normally experienced over the seed-bed season, if left out during the heat of summer, the small cellulose squares tend to fall out of the wire mesh, probably due to the extremes of expansion and contraction to which the material is subjected.

SOIL PREPARATION

Having constructed the frame it is let into the soil to a depth of about one inch. If any form of animal manure is available, a liberal dressing may be spread over the surface of the bed and the soil within the frame dug over deeply. The soil is then worked to a fine tilth. A complete artificial fertiliser at the rate of about 1 lb. to the square yard is thoroughly worked in to a depth of three or four inches. Standard Tobacco Fertiliser or Potato Manure "E" is quite suitable. Finally the surface of the soil is carefully levelled. It is advisable to have the finished surface of the bed two or three inches above the level of the surrounding soil to ensure good drainage.

SOWING THE SEED

One ounce of tobacco seed contains approximately 300,000 seeds, and provided the seed is of high percentage germination, it should be sufficient to sow 100 square yards of seed-bed. With such small seed it is difficult to sow it evenly without using a suitable mixing medium. Usually, fine, light coloured wood ashes or sifted sand is used. The seed is thoroughly mixed with the medium, using at least one to two pints of ashes or sand to every 10 square yards of seed-bed. The mixture is dusted lightly over the bed, going over the area several times until the allowed quantity is used, to ensure even distribution of the seed. Some growers use fertiliser with which to mix the seed, but this is not recommended, as if the mixture is left too long, or under certain conditions, injury to the seed is liable to occur. Another method used, but not recommended by the writer, is to place the seed in a watering-can of water and water it on, constantly agitating the water while it is being applied.

When the seed is sown, the soil is compacted by means of a light roller or gently pressing with a piece of board, to bring the seed into closer contact with the soil particles. The seed should not be raked in as it would be buried too deeply and may not germinate. The bed should be given a light watering immediately after sowing. This should be done with a watering-can with a very fine rose to prevent washing the seed out of position. Great care must be taken not to allow the surface of the bed to become dry until germination has taken place and the young seedlings are established. **Probably the most common cause of failure with tobacco seed-beds is not keeping the bed surface sufficiently moist during the germination period.** During this period depending on weather conditions, it may be necessary to water the seed-bed daily, or on bright sunny days two or more times a day. When "Windolite" is the covering material used it will be found that more frequent waterings are necessary than when covered with calico.

With July sowing germination can generally be expected in about three weeks. Under warmer conditions later in the year, the period may be less.

After the seed is sown, the beds should always be left covered at night and most of the time during the day, but they should be opened periodically for airing. If left covered continuously, the air within the beds becomes stagnant and conditions are set up within

the seed-bed conducive to "damping off" and the growth of moulds and moss on the surface of the bed, which will seriously interfere with germination. Provided conditions are not too drying, the beds may be left uncovered for half an hour or so after watering.

With "Windolite" covers on warm, sunny days, the atmosphere within the bed is liable to become steamy and it is advisable to prop up the covers open an inch or two with small wooden blocks under the corners of the sashes, to ensure adequate ventilation.

In the lower South-West of the State, for early October transplanting it is recommended that the seed should be sown between the end of the third week and the end of July. Successive sowings at weekly intervals, should be made over the next month to cater for later plantings.

The time of sowing can only be determined by the experience of knowing when a particular piece of land will be ready for transplanting. The time at which any piece of land will be ready for planting varies with the season and cannot be accurately forecast in advance. Therefore, it is advisable to stagger the sowing dates for seed, to ensure that an ample supply of plants of suitable size will be available for whenever a particular area of land is ready. If the largest plants in the bed grow too big before the land is ready, it is advisable to pull and discard them, in order that the smaller plants have space to grow properly for use later on.

MANAGEMENT OF THE SEED-BED

When germination has taken place and the young seedlings are established, the seed-bed covers should be opened for a progressively increasing period each day until they are open all day. They should be closed at night and on very cold days and days of heavy rain.

As soon as the individual plants are readily discernible, they should be thinned out if necessary. One plant per square inch is thick enough. One of the best means of thinning-out is to draw a garden rake lightly through the bed, until the whole bed has been raked once, and if necessary crossing at right angles. If when about a week later or when the plants have recovered from the first raking, they are still too thick, the operation may be repeated. Overcrowded seed-beds are most liable to attack by fungus diseases, and are not as likely to produce a strong, hardy seedling. The disease causing the greatest loss of young seedlings is known as "damping off." It is caused by several fungi which produce a rot in the stem of the seedling near the surface of the soil. Growers often find that although their tobacco seed germinated well, seedlings apparently just disappeared shortly after germination. This is usually due to "damping off."

Where seedlings begin to die off in patches it is recommended that they be watered immediately with "Cheshunt Mixture." However, the wise grower does not wait for this disease to make its appearance before adopting remedial measures, but aims at prevention from before the seed is sown. To do this, the bed may be watered with "Cheshunt Mixture" before sowing, and then at weekly intervals from the time the seed has germinated and the young plants have established a root-hold.

"Cheshunt Mixture" is made by thoroughly mixing together two parts by weight of powered copper sulphate (bluestone) or "bluestone fines" and 11 parts of freshly powered ammonium carbonate (rock ammonia). The dry mixture is kept in a tightly stoppered glass or stone jar for at least 24 hours before using. To use, dissolve one ounce of the above mixture in two gallons of water in a copper or pitched-lined vessel and water the solution on to the seed-bed until the surface is nicely moistened. The solution should then be washed off the leaves of the young plants with an equal quantity of pure water. If "damping off" is prevalent in the seed-bed "Cheshunt Mixture" may be used twice weekly. In addition to its action as a fungicide, "Cheshunt Mixture" acts as a fertiliser and helps to stimulate the growth of the young seedlings.



Fig. 3.

A section of a seed-bed showing well-grown, vigorous seedlings ready for pulling for transplanting.

(Photo.: Govt. Photographer.)

Once the young plants are properly established, watering may be reduced and the grower will be guided in the frequency of watering by the state of weather and the condition of the bed surface. The seed-beds will require weeding periodically from the time the weeds are big enough to grasp between the fingers. From the time the leaves of the seedlings are approximately the size of a threepence the beds will require little attention apart from watering, weeding, application of benzol and opening and closing the covers.

As stated earlier, the covers must always be closed at night, on very cold days and in the young stages during very heavy rain. In the later stages heavy rain is not so harmful unless it is heavy enough

to bruise the leaves of the seedlings or is accompanied by hail. Rain during the day can take the place of watering when it comes at convenient times. Contrary to the opinion of some growers, exposing the seed-beds to rain will not induce an attack of "Blue Mould," provided the beds are closed at night and protected by benzol from the time the plants are susceptible to the disease. **From the time the seedlings are an inch high, too much emphasis cannot be placed on hardening-off, by uncovering them for as long a period during the day as possible.** The reduction of watering to a minimum as the plants approach transplanting size also greatly assists in hardening-off.

If the plants are inclined to be yellowish or backward in growth they may be stimulated by the application of liquid manure. For this purpose a small handful of nitrate of soda or sulphate of ammonia dissolved in four gallons of water may be watered on to the bed once or twice a week. To prevent possible damage to the leaves by the solution, it is advisable to water afterwards with pure water. Nitrate of soda is quicker in action than sulphate of ammonia. The application of a weak solution of fowl manure will also be found satisfactory.

CONTROL OF DOWNY MILDEW (BLUE MOULD)

Downy Mildew is the most serious disease affecting tobacco in Western Australia. It is fully discussed in Leaflet No. 486 issued by the Department.

Although it has been recorded that the disease can attack the young seedling at any time from soon after its emergence from the seed, in this State it seldom makes its appearance before the seedlings are three weeks old. The first symptoms of the disease is the occurrence of irregular yellow blotches on the leaves, sometimes mottled with bronzy spots. Later it may be detected by the drying out or shrivelling up of dead areas. On examination of the underside of affected leaves, the blotched area and sometimes a greater area of the leaf tissue will be found to be covered with a fine white to bluish down. This is the fungus causing the disease and its presence is a sure confirmation of "Downy Mildew."

The time at which the disease makes its appearance in unprotected seed-beds is governed by seasonal conditions, but in the lower South-West of the State it seldom occurs before the first week in September.

The use of benzol in seed-beds, properly used, ensures absolute control of the disease. The disease may be controlled by this substance even after the disease has made its appearance, if not too firmly established, but prevention is better than cure and growers are advised to have their seedlings protected by benzol before the disease occurs. Benzol should be used in the lower South-West of the State from the time the seedling leaves are about the size of threepence or from the beginning of September. If the leaves have not reached the required size, when it is known Downy Mildew has made its appearance in the district, it is advisable to protect the seed-bed with benzol, but at half the concentration recommended later in this article. Benzol should be used at full strength as soon as the leaves are big enough. The use of benzol at too high a concentration, too early in the life of the plant, is liable to stunt and deform the young plants.

Benzol is used by evaporating the substance at night under the seed-bed covers. To do this the substance is placed in a number of raised, shallow tins before the beds are covered at the end of the day. In the morning, when the beds are opened, any benzol remaining unevaporated in the tins is emptied back into the container. During stormy weather, the covers should be kept closed night and day, the beds being opened only long enough to replenish the supply of benzol.

The tins for holding the benzol are set up on small stands about three inches above the surface of the soil. The tins are spaced to give even distribution of evaporation within the seed-bed frame and an adequate evaporating surface. The original recommendation was that there should be one square inch of evaporating surface for each square foot of seed-bed surface, or $1/44$ of the area. In practice, however, in Western Australia it has been found that this ratio is not always high enough to afford complete protection and it is recommended that $1/100$ of the area should be evaporating surface. Any kind of tin will do, provided they do not leak, such as tobacco tins, cut-down condensed milk tins, jam tins, etc. They should not be more than one inch deep and preferably not more than $4\frac{1}{2}$ inches wide. The most suitable tin is one three inches in diameter. The greater the number of centres of evaporation, within reason, the more effective will be the control of the disease. Too deep a tin is undesirable, as benzol on vaporisation forms a heavy gas. If the walls of the tin above the surface of the liquid are too high, the gas forms a blanket over the liquid and the rate of evaporation is greatly reduced.

The following table gives the approximate area of evaporating surface from round tins of given diameter.

Diameter of Tin.	Area of Evaporating Surface.
2 inches	3 square inches.
$2\frac{1}{2}$ inches	5 square inches.
3 inches	7 square inches.
$3\frac{1}{2}$ inches	$9\frac{1}{2}$ square inches.
4 inches	$12\frac{1}{2}$ square inches.
$4\frac{1}{2}$ inches	16 square inches.

From this table the grower can calculate how many tins of given diameter are required for any seed-bed. For example, if it is desired to treat a seed-bed 18 feet long by three feet wide the total area of the bed is $(18 \times 3 \times 144) = 7,776$ square inches. This figure

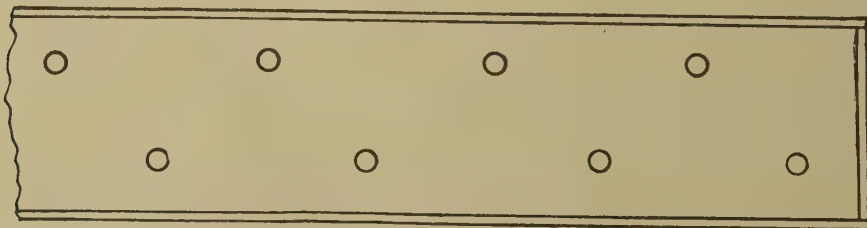


Fig. 4.

divided by 100 gives the area of evaporating surface required = 77.76 square inches. If the tins to be used are three inches in diameter, each of which has an evaporating surface of seven square inches, the number of tins required is 77.76 divided by 7 = 11 tins, discounting the fraction. The tins should be placed in two rows along the bed, each row being one quarter of the width of the bed from the edge and the tins staggered as shown in figure 4.

Benzol in the liquid state is absolutely fatal to seedlings and the greatest care should be exercised to prevent spilling or splashing when the tins are being filled. While some growers use a kettle for filling the tins, it will be found more satisfactory to make or have made a proper benzol filler. This filler is shown in the illustration of adding benzol to the bed. It is constructed from a suitable tin or galvanised iron cylinder about seven inches in diameter and six inches in depth. To the bottom of this is soldered a cone about four inches deep with an opening in the bottom just large enough to fit and solder in a short length of $\frac{5}{16}$ inch copper pipe. This pipe should be bent at right angles. Over the protruding portion of pipe, one end of about 30 inches of $\frac{1}{4}$ in. rubber tubing is placed and wired in position. A top is soldered on to the top of the cylinder to which a convenient handle is attached and an opening made just large enough to permit of easy filling of the container with benzol. Three sturdy strap iron legs are attached to the base of the cylinder to support the filler when being filled or put down. The free end of the rubber tube, when not in use, should be supported by a clip attached



Fig. 5.

An illustration of the benzol filler described, in use.

(Photo.: Govt. Photographer.)

to the handle of the container to prevent spillage of benzol. To fill the tins, the container is carried in the left hand and the end of the tube in right hand. The end of the tube is pinched together with the fingers and released over each tin for filling. It is essential that each tin should be filled to within one-quarter inch of the top to ensure maximum evaporation of benzol. Unevaporated benzol should always be removed from the tins each morning and returned to the container as the substance is volatile and costly and should not be wasted. Also, if the watering is carried out with the benzol in the tins or if it should rain the liquid will be splashed on to the plants with harmful effect.

Growers should always ensure that genuine benzol is used. Although certain other substances give varying degrees of control, none are as effective as benzol. Benzol is defined as that portion of the light-oil distillate of coal tar with initial and final boiling points of 70° C and 98° c respectively and having a specific gravity of 0.882 at 60° F. Benzol is highly inflammable and should not be handled near an open flame. The quantity of benzol evaporated in seed-beds will vary with weather conditions and the type of seed-bed used. Under average conditions consumption can be expected to be a little over one pint per square yard per week.

A concentration of benzol of up to 50 per cent. greater than that recommended is generally not harmful to tobacco seedlings, but some injury may occur if the concentration is too great. Under certain conditions, injury may occur with the recommended concentration. Should this happen, the number of tins in the bed should be reduced and the rest re-distributed to ensure even concentration. Symptoms of benzol injury differ under varying conditions. Too high a concentration sometimes causes a yellowing and mottling of the leaves with general stunting of the plants, whereas in other cases the leaves become very thick, brittle and malformed. Another form of benzol injury is the burning of the tips of the leaves, and this is often the case, if during windy weather, the wind gets under the cover and concentrates the benzol vapour at one end of the bed.

If Downy Mildew should make its appearance before benzol is applied, or due to the use of too low a concentration of the substance, immediate remedial measures should be taken. If early symptoms are apparent on only a few plants, or patches, the infected plants should be destroyed, but if the symptoms are general and the grower cannot afford to destroy all the plants in the bed, plants showing advanced symptoms of the disease only should be dug out. The concentration of benzol should be increased by at least 50 per cent. by the addition of extra tins to the bed, all tins filled and kept filled and the beds covered continuously for at least one week. After this period the treatment can revert to normal, but the plants should be carefully watched for the development of further disease symptoms. If the increased concentration of benzol has been effective, the leaf spots may remain, but there should be no development of the fungus under the affected areas. The presence of the fungus down on the leaf is a sure indication that the disease has not been controlled.

Once the use of benzol has been commenced it should be continued each night until further seedlings are no longer required.

CONTROL OF INSECT PESTS

Provided the seed-bed area is prepared early and kept free from weeds as recommended earlier in this leaflet, little trouble should be experienced with insect pests. It is only when land which is carrying weeds, grass or clover is hastily prepared late in the season that serious trouble from insect pests might be expected.

The most common pests that cause damage to tobacco plants in the seed-beds are red-legged earth mite, slugs, cut-worm and seed harvesting ants. Once the use of benzol commences little trouble is experienced with insects.

Reg-legged earth mite is readily controlled with D.D.T. dust or sprays. Spraying of the wood-work of the seed-bed frame inside and out with commercial preparations of D.D.T. out-door spray will prevent the entry of the pest into the bed. If the mites are already in the bed, the plants may be lightly dusted with D.D.T. dust, but if dusted too heavily or too frequently seedlings may be affected as shown by the development of symptoms of yellowing or mottling of the leaves.

Slugs may be controlled by the use of commercial preparations containing metaldehyde, or a bait may be prepared by mixing this substance with bran. The mixture is moistened and placed in small heaps in close proximity to where damage is occurring. Metaldehyde can often be obtained in the form of "Meta" heat tablets.

Cut worms and other chewing insects can be dealt with by placing small heaps of a bran-paris green-molasses poison bait close to where insect eaten leaves are to be seen. This bait can be made by mixing 40 lb. bran, 1 lb. paris green and 3 lb. molasses with enough water to make a crumbling mash. The bran and poison are mixed together dry, and the molasses or treacle with sufficient water to make it liquid. The two are then mixed to a consistency of a crumbling mash.

Sometimes certain species of ants gather the seed from the surface of the bed and store it in holes or small heaps, generally around the edge of the bed. The ants will usually be seen at work, but if they are not noticed, the result of their activities will be apparent by the poor germination over the bed and if the seed has not been stored below ground, it will germinate thickly in the heaps in which it has been stored. The ants can be readily controlled by placing in the bed small dishes of any proprietary sweetened ant baits, preferably one containing D.D.T.

TRANSPLANTING

The seedlings are ready for transplanting when from four to six inches high. If allowed to remain in the seed-bed beyond this stage the plants will tend to become spindly and will not withstand transplanting under adverse conditions as well as a short, stocky plant. Before pulling, the seed-bed should be thoroughly watered, in order that the seedlings may be lifted from the soil with the minimum of damage to the roots. When pulling, the plants may be lifted by taking the two largest leaves between the thumb and forefinger, or by reaching down and grasping the plant at soil level.

The greatest care should be taken not to injure the growing tip of the plant. A little bruising of the outside leaves will do not harm as they will be removed before harvest. After all plants of suitable size have been removed, the bed should again be watered to set the disturbed soil around the roots of the smaller plants, to allow them to continue to grow for future pulling.



Fig. 6.

Pulling seedlings for transplanting.

(Photo.: Govt. Photographer.)

In conclusion, the grower who can by good management, provide himself with an ample supply of healthy, vigorous seedlings will have made a substantial step towards a successful crop. With strong seedlings transplanted from the beds to the field with the minimum of delay, there should be little replanting required. This results in even growth in the field and even maturity of the leaf. The importance of this cannot be stressed too strongly, as even ripening of the crop in uniform plant position greatly simplifies the curing of the leaf.

Register of Merit

M. CULLITY, Superintendent of Dairying.

At a meeting with representatives of the Dairy Breed Societies held in the Royal Agricultural Society rooms on the 20th September, 1949, various matters regarding the rules under which pure bred dairy cattle were recorded were discussed.

Amongst other things it was decided that it was most desirable that merit registers should be commenced and that for these registers there should be uniform rules with the remainder of the Commonwealth. The latter decision also applied to the methods of testing generally and the basis for carrying out sire surveys.

The representatives of the Breed Societies agreed unanimously to the preparation of Registers of Merit in order to focus attention upon the value in the breeding programme of the cow with consistent high yields in a number of lactations.

The present day emphasis in breeding is upon sires and their selection through progeny testing. Various methods of carrying out sire surveys have been suggested and are in operation in different parts of the World, but while they contribute towards the finding of a few superior bulls, the general principles under which the work is carried out are not yet above criticism.

One of the major unfortunate results of the emphasis upon the sire is the tendency to overlook the part that the dam can play. This, no doubt, is due to the fact that a sire may get 40 times as many daughters as any cow.

In respect to any individual heifer it is accepted that the dam contributes as much to the constitution and productivity as the sire, and therefore it is obvious that considerable care should be taken in the selection of the superior females to use with the best sires.

This is not a new thought, but it is necessary to re-state it, as the concentration upon the value of sire surveys has tended to develop a method of thinking of improving pure bred cattle by mass methods, that is by grading up for yield rather than the intelligent selection of the very best females and the very best sires.

In Herd Recording, for many years there has been a tendency to look to single superior performances as indicating the value of a cow. On many occasions the single performances have been followed by several lactations in which the animal has produced at only average or lower levels. There are very many cows which have never come into prominence with a superior performance in an individual lactation, but which, by consistent yearly calvings and moderate productions, have been most profitable over the period that they have been in the herds. It is the lifetime performance of these cows which is the real measure of their worth.

At the meeting of the Breed Societies, referred to earlier, there was a general agreement that there should be greater emphasis in the recording of pure bred herds on lifetime performances of individuals and strains, and on the general performance of herds as groups.

The preparation of the Merit Register has been carried out in order to provide breeders with a record of the performances of cows which, during their lifetime, have produced up to certain arbitrarily determined standards. Later these records will become of historical interest as new generations of dairy cattle come into production.

In order to achieve uniformity throughout the Commonwealth the basis for Merit Registers has been discussed with the Technical Sub-Committee on Dairy Cattle reporting to the Australian Animal Production Committee. It was indicated that in this State the standards, which would be adopted, would be those used in New South Wales and published in 1949. To avoid confusion the actual wording of the standards used in that State as adopted for Western Australia is given as follows:—

Standards adopted in preparing the Register of Merit are:—

Intermediate Merit Register.

Lifetime Merit Register.

“Elite” Entries in the Lifetime Merit Register.

Intermediate Merit Register.

Rules governing entry in this Register are:—

1. (a) Total production from three successive lactations.—To qualify, a cow recorded under the Pure Bred or the Dairy Herd Improvement Scheme must have produced in three (3) successive lactations during a period of three (3) successive years, a total of at least 1,100lb. butterfat. That total must be produced before the animal reaches the age of eight (8) years.

It shall, however, be reduced to 1,050lb. butterfat if the cow commences the first qualifying lactation at an age of less than 2 years 183 days.

Until September, 1950, consideration will be given to entry in the Intermediate Register of Merit for cows irrespective of age.

- (b) Minimum production in each lactation.—To qualify a cow must have produced in each lactation at least 300lb. of butterfat, except that in the case of a lactation commencing before the age of 2 years 183 days the minimum standard shall be 275lb. of butterfat.
- (c) Length of lactation recording period.—Production for each lactation shall be based on the first 273 days from commencement of the recording.

(d) Information to be recorded.—The Register shall show—

- (i) the name of the recording member;
- (ii) the full name of the cow;
- (iii) the herd book number;
- (iv) the name of sire;
- (v) the three (3) qualifying productions;
- (vi) the age of the cow;
- (vii) the date of calving prior to commencement of each qualifying lactation;
- (viii) The average test, lb. of fat and number of days for each lactation.

2. All records eligible will be automatically included in the Register.

Lifetime Merit Register.

Rules governing entry in this Register are:—

- 1. (a) To qualify, a cow must be credited with a total production of at least 2,240lb. of butterfat under the Pure Bred or the Dairy Herd Improvement Scheme, in not more than eight (8) and not less than four (4) lactation periods.
- (b) There shall be no correction for age.
- (c) There shall be no restriction as to age at commencement of the recordings.
- (d) No charge shall be made for entry in the Register.
- (e) Recordings shall be based on the first 273 days from commencement of recordings.

2. The owner must make an application to include in the Register any grade cow which had qualified prior to 1st October, 1950, and such application will only be accepted if the cow is then individually identifiable in accordance with the rules.

- 3. (a) The records of all eligible cows will be automatically included in the Register.
- (b) Excepting "Elite" Certificates, Certificates will not be issued for records completed prior to 30th September, 1950, in both schemes. The Pure Bred Production cards now in use will constitute the Certificate of Merit to 30th September, 1950.
- (c) Production figures for later than 30th September, 1950, will not be recognised for Lifetime Merit Register purposes unless before the completion of that lactation the cow was individually identifiable to the satisfaction of the Department. Registration in the Herd Book shall be regarded as satisfactory individual identification for a pedigree cow.

4. A certificate will be issued free on application and shall include for each lactation, date of calving, lb. of milk, butterfat percentage, lb. of fat, and days in milk.

5. Records subsequent to the issue of the Certificate may be added on application to the Superintendent of Dairying, Department of Agriculture, Western Australia.

6. For entry in the Lifetime Merit Register it will be permissible for an individual grade cow—not necessarily a whole herd—to be identified in accordance with the rules governing the Herd Production Improvement Scheme (Tattoo, Fire or Acid Brand).

“Elite” Entries in the Lifetime Merit Register.

The rules governing entry in the Lifetime Merit Register shall apply to the “Elite” entries, subject to the following qualifying standard:—

To qualify for an “Elite” entry a cow must be credited with a total production of at least 3,600lb. of butterfat under Pure Bred or Grade Herd Recording, during a period of not more than ten (10) lactation periods.

No Allowance for Age.

Entry to the Register of Merit is based on actual butterfat production. No corrections are made for age, except for the allowance referred to in the rules governing the Intermediate Merit Register. Thus the possibility of an error being introduced through any correction factor being in itself incorrect is avoided.

Record Productions.

While depreciating the value of individual lactation yields as the *sine qua non* of a cow's productive worth, there will always be interest in outstanding performances and therefore the following tables of record productions are given.

It is interesting that each of the State all breed records is held by a West Australian bred cow.

A further table is given showing the top six individual yields for each of the Jersey, Guernsey and Shorthorn breeds.

NUMERICAL AND BREED COMPOSITION OF THE REGISTER.

Register.	Jersey.	Guernsey.	A.I.S.	Total.
GOVERNMENT.				
Intermediate	1	20	13	34
Lifetime	4	19	....	23
Elite ....	....	2	....	2
PRIVATE.				
Intermediate	64	25	53	141
Lifetime	13	11	19	43
Elite ....	....	....	....	....
TOTAL.				
Intermediate	65	45	66	176
Lifetime	17	30	19	66
Elite ....	....	2	....	2
				244

ELITE LIFETIME REGISTER OF MERIT.

GUERNSEYS.

Name of Cow.	Herd Book No.	Age at Start of Recording.		Age at Finish of Recording.		No. of Records.	Total Milk (lb.)	Average Test. (%)	Total Butterfat. (lb.)	Name of Sire.	Herd Book No. of Sire.
		Years.	Months.	Years.	Months.						
DENMARK RESEARCH STATION.											
Denmark Dawn 2nd	5439	2	4	13	1	9	66,018	5.8	3,861.00	Koojan Golden Prosper	2283
Denmark Golden Dawn	4118	2	2	14	0	10	65,073	6.00	3,934.00	Koojan Golden Prosper	2283

LIFETIME REGISTER OF MERIT.

Name of Cow.	Herd Book No.	Age at Start of Recording.		Age at Finish of Recording.		No. of Records.	Total Milk (lb.)	Average Test. (%)	Total Butterfat. (lb.)	Name of Sire.	Herd Book No. of Sire.
		Years.	Months.	Years.	Months.						
GUERNSEYS.											
P. G. HAMPSHIRE & SON.											
Brookfields Lady Faith	4062	2	3	11	2	7	60,599	4.90	3,011.15	Koojan Lord Barclay	1031
Langdowne Morden Lady	3479	2	11	9	11	6	48,235	5.20	2,551.66	Koojan Golden Broadcaster	1632
Newry Lady Freda	2719	3	9	11	2	6	48,632	5.50	2,680.41	Koojan Mack	596
DENMARK RESEARCH STATION.											
Coogely Jonquil	6945	3	5	10	2	7	46,324	6.10	2,838.90	Coogely Judy's Goldmine	2621
Denmark Bonnie Mary	6958	3	10	11	0	6	44,364	5.20	2,320.83	Denmark Illustrious	3320
Denmark Briar Rose	6959	3	1	10	2	7	55,483	5.10	2,840.30	Denmark Illustrious	3320
Denmark Diana	6963	4	0	11	8	8	53,962	5.30	2,898.07	Denmark Damon	2519
Denmark Golden Marie	3873	2	2	9	2	7	51,588	5.60	2,901.12	Koojan Golden Prosper	2283
Denmark Golden Valencia 2nd	8535	2	2	8	9	7	55,270	5.40	3,036.15	Koojan Ace's Goldseeker	3431
Denmark Orange Bud	4123	2	9	10	12	8	68,483	4.70	3,234.21	Koojan Golden Prosper	2283
Denmark Rose Dame	1794	2	7	10	10	8	61,602	4.60	2,842.77	Rose Chief of Wollongbar	130
Denmark Rosette	6972	2	0	9	10	8	49,120	5.50	2,710.27	Koojan Golden Prosper	2283
Denmark Rosemary	5451	2	1	9	7	7	46,732	6.00	2,810.50	Koojan Golden Prosper	2283
Koojan Ace's Dulcie	5658	2	7	9	10	7	67,691	5.50	2,668.52	Homestead Ace	1631
Koojan Dame	7248	2	0	14	0	7	61,751	4.70	2,934.38	Robin of Nundorah	417
Koojan Golden Ripple	6956	1	2	9	5	8	43,467	5.10	2,241.62	Homestead Ace	1631
Denmark Angelina	819	4	2	11	0	8	46,558	5.40	2,514.53	Koojan Golden Prosper	2283
Rosewood Colleen	1164	3	7	10	11	7	47,652	5.30	2,538.78	Archer of Nundorah	76
Denmark Anne	3273	2	3	11	4	7	48,893	4.90	2,425.39	Linwood of Wollongbar	381
Denmark Prosper's Lady	4127	2	4	12	10	8	45,810	5.60	2,599.99	Koojan Golden Prosper	2283
Denmark Prosper's Rosa		2	4	9	8	8	54,500	5.30	2,834.77	Koojan Golden Prosper	2283
A. W. PADBURY.											
Koojan Ace's Jean	5660	1	7	6	4	5	38,384	5.80	2,248.01	Homestead Ace	1631
Koojan Ace's Jewel	3353	2	5	7	4	5	48,358	5.20	2,548.59	Homestead Ace	1631
Koojan Ace's Mignonette	3898	2	5	7	11	6	43,892	5.90	2,614.52	Homestead Ace	1631
Koojan Bonnie Jean	1612	2	7	8	11	6	52,041	5.90	3,072.41	Robin of Nundorah	417
Koojan Dulcie	1255	2	2	9	4	5	40,679	5.60	2,283.91	Robin of Nundorah	417
Koojan Golden Butterfly	4339	2	9	7	2	5	44,720	5.40	2,424.22	Koojan Ace	2270
Koojan Golden Jewel	8805	2	4	6	9	5	42,237	5.60	2,386.13	Koojan Beau Ideal	4965
Koojan Wavelet	1619	2	0	8	2	6	47,269	5.20	2,481.67	Robin of Nundorah	417
MURESK AGRICULTURAL COLLEGE.											
Muresk Rose	2156	2	1	11	5	8	54,445	5.20	2,864.90	Triumph of Wollongbar	513

JERSEYS.

DEPARTMENT OF AGRICULTURE.

Banyule Silvermine 55th	...	25473	3	4	6	11	4	41,519	5-65	2,347-45	Air Lord of Banyule	...	3337
Clarendon Eyre Betty	...	39244	1	11	10	6	8	58,573	4-17	2,418-38	Clarendon Eyre Eminent's Achieve- ment	...	4154
Grangelea Pretty Primrose	...	33038	1	11	8	5	6	41,636	5-69	2,371-85	Banyule Airo	...	5751
Grangelea Buttercup	...	26388	2	1	11	1	7	45,808	5-24	2,376-11	Grangelea Daisy's V.C.	...	5079
C. E. KRUGER.													
Camden Ariadne	...	85538	1	11	6	10	5	39,243	6-64	2,606-85	Greenmount Golden Sultan	...	14688
K. V. GRAY.													
Camden Circe	...	80637	2	9	9	4	6	38,875	6-32	2,459-10	Greenmount Golden Sultan	...	14688
D. BRADFORD.													
Congelin Iolanthe 8th	...	80828	3	...	7	1	5	51,270	5-26	2,695-92	Roscliffe Marchalong	...	15094
Congelin Rose Marie 6th	...	80830	3	1	8	1	6	51,531	6-19	3,193-00	Roscliffe Marchalong	...	15094
MRS. G. H. BURNSIDE.													
Crantock Cream Lass	...	43542	3	3	11	10	8	47,590	5-99	2,855-09	Crantock Starbright's Montrose	...	5945
Crantock Primula's Tulip	...	70960	1	9	7	5	7	41,811	5-87	2,457-78	Congelin Eminent's Golden	...	13623
R. H. ROSE.													
Lady Fowler 3rd of Grass Vale	...	19111	2	8	9	9	6	50,740	5-32	2,699-50	Rye Duke of Glen Iris	...	1994
Lady Fowler 33rd of Grass Vale	...	92716	2	9	6	10	5	45,717	5-45	2,490-86	Mornmoot Northwood Beau	...	17798
A. G. SCOTT.													
Greenmount Starbright's Marinora	...	34841	1	10	9	5	8	52,269	5-69	2,974-20	Werrilee Starbright King	...	2602
MISS L. G. HANGCOCK.													
Juadine Peerless Lily 13th	...	76977	1	9	6	8	5	44,822	6-25	2,804-66	Austral Park Wonderful Standard	...	12423
L. M. TEMPLE.													
Radyr Park Dorothy 4th	...	63850	1	11	13	...	8	58,301	5-14	2,099-53	Greenmount Graceful Lad	...	7292
Radyr Park Dorothy 5th	...	68752	2	...	11	11	7	41,532	5-56	2,309-14	Greenmount Graceful Lad	...	7292
W. H. & T. F. ROBINSON.													
Spring Park Starbright's Queen	...	24901	1	9	8	1	5	40,487	5-79	2,346-67	Grass Vale Prince Marinora	...	4582

LIFETIME REGISTER OF MERIT—continued.

A.I.S.

Name of Cow.	Herd Book No.	Age at Start of Recording.		Age at Finish of Recording.		No. of Records.	Total Milk (lb.)	Average Test. (%)	Total Butterfat. (lb.)	Name of Sire.	Herd Book No. of Sire.
		Years.	Months.	Years.	Months.						
W. G. BURGESS.											
Blacklands Beauty 10th	9279	2	...	6	5	5	54,588	4.11	2,243.82	Fussy's Monarch of Hill View	493
Kurrawong Kathleen 5th	16027	2	2	7	8	6	59,437	4.07	2,420.12	Premier of Kurrawong	1212
Kurrawong Kitty 8th	16030	2	3	9	3	7	72,234	4.61	3,329.62	Premier of Kurrawong	1212
New Park Sally 9th	1873	2	10	9	1	7	79,215	3.61	2,858.97	Ruler of Greyleigh	1855
Tabbagong Dove 11th	14421	2	2	7	9	6	63,288	4.09	2,503.99	Parkview Reward 2nd	260
Hope 3rd of The Hill	15710	2	9	7	6	5	55,376	4.26	2,358.02	Crescent of The Hill	2016
Yallah Farm Maggie 2nd	1272	3	11	8	...	5	74,607	3.85	2,833.65	Fussy's Favo of Park View	2149
Eastview Gold	10940	1	9	9	1	6	52,419	3.61	2,464.16	Mariner of Greyleigh	587
Tabbagong Dove 4th	14725	...	...	10	8	6	71,988	4.06	2,899.73	Mayflower Repeater of Hill View	905
D. BEVAN & SONS.											
Blacklands Ettie 9th	9298	2	1	9	2	6	67,680	4.22	2,859.68	Park View Linelight	370
Glanavon Dahlia 7th	30581	2	6	8	6	6	60,651	4.21	2,555.66	Glanavon Neptune	3959
Glanavon Rosina	30603	2	5	9	4	6	62,712	4.74	2,975.35	Blacklands Jean's Supreme	1871
Glanavon Tiny	20212	2	2	8	10	5	59,199	4.16	2,404.77	Blacklands Jean's Supreme	1871
Leylands Melba	17170	2	3	7	2	5	54,117	4.42	2,391.64	Widgee Waa Record	848
Nancy 9th of Raleigh	17519	3	4	9	5	8	72,639	4.85	3,526.04	Union Jack of Raleigh	2375
Pansy 5th of The Hill	15729	2	6	8	5	6	67,533	3.98	2,693.56	Crescent of The Hill	2016
BAXLEY BROS.											
Westby Polly	15141	2	4	12	...	8	59,472	3.89	2,318.18	Telyarup Duke	956
E. T. THATCHER.											
Wooroloo Duchess II.	15324	2	2	7	10	6	60,102	4.03	2,421.28	Triumph of Pine Creek	2515
Wooroloo Milkmaid V.	15339	2	1	7	5	6	59,398	3.87	2,304.38	Park View Guardian	2557

INTERMEDIATE REGISTER OF MERIT.

GUERNSEYS.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat (lb.)	
P. G. HAMPSHIRE & SONS.								
Brookfields Lady Lilian	2720	11-5-32	2	6	5,997	5.0	303.15	273
Koojan Lord Barclay	1031	3-7-33	3	8	7,507	5.0	380.16	273
		18-7-34	4	8	9,207	4.8	447.45	273
GIBBLETT & JOHNSTON.								
Burnside Judy	2540	19-7-31	2	2	5,585	5.6	312.57	273
Minnamurra Prairie Don	743	20-10-32	3	5	5,983	5.8	349.04	273
		24-11-33	4	7	8,022	6.0	484.48	273
J. CABASSI.								
Clovelly Crystal	10240	20-6-46	4	10	7,285	4.8	354.69	273
Koojan Monogram	4174	8-6-47	5	10	7,590	4.5	343.20	240
		8-5-48	6	9	8,151	5.0	411.95	273
Clovelly Lily	10244	23-7-46	3	11	6,568	5.3	352.11	273
Lansdowne Polydymite	4995	13-7-47	4	11	7,479	5.5	411.57	273
		30-5-48	5	9	6,745	5.5	374.96	273
R. J. GILES.								
Coogely Zonia	5430	13-10-38	4	3	7,862	5.1	407.08	273
Koojan Forty Winks	2738	11-5-40	5	10	8,426	5.7	485.45	273
		15-5-41	6	10	9,216	6.0	553.58	273
A. W. PADBURY.								
Cookalabi Jewel	3771	19-12-31	2	3	6,069	5.2	301.58	273
Cookalabi Pride	2456	19-2-33	3	5	7,497	4.8	362.43	273
		7-3-34	4	6	8,556	4.8	422.08	273
Koojan Ace's Daphne	5657	9-10-36	2	2	6,405	5.0	322.39	273
Koojan Ace	2270	3-10-37	3	2	7,725	5.4	420.80	273
		13-9-38	4	1	7,178	5.1	372.84	273
Koojan Ace's Diplomat	13489	18-8-45	2	....	5,976	5.4	325.38	273
Homestead Ace	1631	21-8-46	3	....	7,467	5.5	411.14	273
		26-8-47	4	....	8,064	5.9	481.56	273
Koojan Ace's Jewel 2nd	5661	14-4-38	3	1	8,207	5.0	411.10	273
Homestead Ace	1631	15-8-39	4	5	13,169	5.1	683.45	273
		18-9-40	5	6	14,540	5.5	801.16	273
Koojan Ace's Pixie	4336	24-3-38	4	11	8,376	5.1	429.30	273
Homestead Ace	1631	10-9-39	6	5	10,825	5.1	555.88	273
		21-9-40	7	5	11,664	5.1	603.82	273
Koojan Bonnie Elizabeth	1899	28-1-31	3	10	7,077	5.8	411.77	273
Robin of Nundorah	417	7-4-32	5	1	7,452	5.9	443.05	273
		5-5-33	6	2	9,253	6.1	570.97	273
Koojan Bonnie Evelyn	3899	3-8-34	2	4	7,220	5.5	402.49	273
Homestead Ace	1631	13-9-35	3	5	7,761	5.7	446.63	273
		20-10-36	4	6	6,725	5.9	402.25	273
Koojan Bo Peep	3542	18-4-33	2	2	6,759	5.7	390.15	273
Homestead Ace	1631	3-9-34	3	7	9,392	4.5	425.26	273
		2-11-35	4	9	7,755	5.5	429.10	273
Koojan Bo Peep 2nd	7246	15-1-39	1	9	6,609	5.3	355.90	273
Koojan Ace's Aristocrat	2730	16-3-40	2	11	7,473	5.5	415.19	273
		24-1-41	3	9	9,639	5.6	548.93	273
Koojan Ida	1900	1-7-29	2	5	6,306	5.3	339.16	273
Robin of Nundorah	417	2-9-30	3	7	7,632	5.2	403.06	273
		15-9-31	4	7	7,403	5.4	409.49	273
Koojan Ideal's Bluebell	8807	17-2-41	2	1	6,234	5.9	372.14	273
Glenburnie Ideal	2548	9-6-42	3	5	6,552	5.8	384.47	273
		11-7-43	4	6	7,239	5.7	418.13	273

INTERMEDIATE REGISTER OF MERIT—continued.

GUERNSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
A. W. PADBURY—continued.								
Koojan Lady Olive	4340	9-2-37	4	....	8,895	4.9	443.55	273
Homestead Ace	1631	25-3-38	5	1	9,537	5.1	490.61	273
		7-9-39	6	7	11,369	5.3	612.28	273
Koojan Noblemark's Bo Peep	13512	26-8-45	2	10	8,610	5.0	432.31	273
Koojan Ideal's Noblemark	5949	1-10-46	3	10	10,557	5.4	577.07	273
		12-11-47	4	11	9,855	5.7	567.97	273
Koojan Polly	2665	21-10-31	2	10	7,041	5.1	363.17	273
Koojan Golden Governor	595	13-9-32	3	9	6,961	5.4	377.46	273
		30-8-33	4	8	7,453	5.2	389.77	273
Milton's Daisy 2nd	922	18-6-24	2	11	6,976	5.3	376.19	273
Wickham Goldraiser	214	23-6-25	3	11	6,787	4.9	338.82	273
		7-8-26	5	1	9,367	5.1	484.17	273
Milton's Dulcie 2nd	928	14-4-24	2	8	8,571	5.0	433.93	273
Longwater Illustrious	269	14-4-25	3	8	7,707	5.0	392.94	273
		25-5-26	4	9	9,894	5.1	513.52	273
Yarraview Bonnie Annie	564	13-4-21	3	9	6,665	6.2	418.20	273
Yarraview Golden Cherub	3147	26-5-22	4	10	6,189	6.3	392.01	273
		7-6-23	5	11	8,127	6.1	496.63	273

DENMARK RESEARCH STATION.

Denmark Bonnie Princess	12676	20-5-46	3	6	7,299	4.7	344.66	273
Koojan Ideal's Reflection	4974	29-6-47	4	7	9,186	4.8	447.58	273
		11-9-48	5	10	8,744	5.2	460.93	273
Denmark Dame	6960	6-11-41	3	5	10,311	4.0	420.77	273
Koojan Golden Prosper	2283	15-2-43	4	8	8,418	4.7	396.28	273
		19-5-44	5	11	8,643	4.7	414.06	273
Denmark Golden Glory	6965	5-9-41	3	4	6,924	5.4	374.22	273
Denmark Damon	2519	16-9-42	4	4	7,872	5.4	428.68	273
		20-8-43	5	3	7,732	5.1	396.42	273
Denmark Golden Valencia	8534	23-2-42	2	5	7,242	5.1	374.37	273
Koojan Ace's Goldseeker	3431	10-2-43	3	5	7,383	4.8	355.18	273
		21-4-44	4	7	7,756	5.1	401.50	273
Denmark Orange Pekoe	5444	6-10-39	3	4	6,717	4.6	309.89	273
Denmark Damon	2519	14-9-40	4	3	7,044	5.3	375.26	273
		26-8-41	5	2	8,487	5.5	468.96	273
Denmark Petal	6968	20-7-40	2	9	7,500	5.6	420.90	273
Koojan Golden Prosper	2283	24-11-41	4	1	7,983	6.5	525.95	273
		26-6-43	5	8	9,021	5.5	502.45	273
Denmark Reflectionette	12691	1-6-45	2	7	6,225	4.8	303.13	273
Koojan Ideal's Reflection	4974	14-10-46	3	11	7,329	5.7	423.21	273
		16-11-47	5	....	8,787	5.9	525.48	273
Denmark Rosebud	3876	12-10-36	4	7	6,668	5.4	361.38	273
Wollongbar McQuarrie	1244	2-5-38	6	2	7,077	5.3	387.67	273
		15-4-39	7	1	8,937	5.8	525.56	273
Wollongbar Golden Pearl 4th	863	8-6-24	2	4	6,882	5.6	385.79	273
Judge of Wollongbar	184	12-11-25	3	9	7,908	5.6	448.77	273
		2-12-26	4	10	6,612	5.3	351.16	273

G. E. SCOTT.

Karridale Girlie	3820	25-7-35	4	10	6,654	5.3	350.59	273
Minnamurra Rose Chief	1016	18-9-36	6	....	8,138	5.1	415.72	273
		28-9-37	7	....	7,855	4.7	372.72	273
Karridale Lady Betty	2331	10-6-32	3	9	7,381	5.2	386.94	273
Minnamurra Oliver Twist	528	20-7-33	4	10	9,166	5.3	488.04	273
		15-8-34	5	11	8,663	4.8	421.11	273
Karridale Queen	2754	9-8-32	3	9	9,360	5.3	493.95	273
Minnamurra Oliver Twist	528	5-1-34	5	2	8,160	5.0	410.83	273
		6-3-35	6	4	9,095	5.3	484.85	273

INTERMEDIATE REGISTER OF MERIT—continued.

GUERNSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
MURESK AGRICULTURAL COLLEGE.								
Minnamurra Palm Olive	2616	27-4-33	3	8	6,906	4.7	331.09	273
Caramana Favour	652	24-4-34	4	8	9,141	4.1	380.21	273
		17-4-35	5	8	8,041	5.3	432.85	273
Minnamurra Prairie Belle	2619	19-10-33	3	11	7,083	4.9	349.77	273
Minnamurra Rex	1322	23-3-35	5	4	8,217	4.9	405.80	273
		11-5-36	6	6	7,334	5.1	374.24	273
Minnamurra Sun Lady	2811	23-8-33	3	6	5,790	5.4	315.03	273
Minnamurra Justice	1012	13-4-35	5	2	7,921	6.0	477.47	273
		19-7-36	6	5	6,819	5.6	382.49	273
Muresk Anna	11058	9-12-45	3	3	7,332	4.5	330.33	273
Koojan Ideal's Dictator	4167	8-3-47	4	6	10,663	4.6	491.12	273
		18-2-49	6	3	8,847	4.5	402.32	273
Muresk Awas	13921	26-5-46	2	....	6,951	4.6	324.66	273
Koojan Ideal's Dictator	4167	9-7-46	3	2	8,484	4.1	355.81	273
		28-7-48	4	2	9,768	4.4	433.88	273
Muresk Damsel	4720	9-5-37	3	6	7,839	4.9	387.45	273
Muresk Homestead	2075	23-2-39	5	3	7,701	4.9	383.07	273
		16-4-40	6	5	9,636	4.9	480.66	273
Muresk Delicia's Pride	13923	22-7-46	3	1	6,801	4.8	327.84	273
Koojan Ace's Warspite	5943	10-8-47	4	2	9,474	4.8	455.73	273
		22-9-48	5	3	7,866	4.7	370.94	273
Muresk Jessica	13935	2-10-46	2	3	6,753	4.8	325.44	273
Koojan Ideal's Dictator	4167	26-9-47	3	2	77,977	4.7	373.07	273
		16-2-49	4	7	7,215	5.0	364.03	273
Muresk Lady Boniface	11067	12-8-45	4	4	5,814	5.2	303.97	273
Denmark Damon	2519	19-5-46	5	1	6,558	5.8	386.68	273
		20-7-47	6	3	9,429	5.3	505.13	273
Muresk Primrose	2527	19-4-33	4	1	5,956	5.4	324.10	273
Triumph of Wollongbar	513	9-8-34	5	5	7,501	5.5	415.66	273
		6-8-35	6	5	6,644	5.5	365.54	273
Wyuna Jean	2471	15-5-33	3	8	6,603	4.8	314.02	273
Nundorah Buccaneer	612	22-5-34	4	8	8,410	5.0	426.25	273
		2-8-35	5	11	7,776	4.8	374.49	273

JERSEYS.

SABINA VALE STUD FARM.

Berrington Soprano 2	28851	19-1-33	3	3	5,263	5.90	311.66	273
Banyule Superstrain	4529	19-5-34	4	7	8,049	5.63	453.52	273
		21-7-35	5	10	7,998	5.04	403.00	273
Sabina Vale Countess	55175	7-7-35	3	2	7,452	5.81	424.33	273
Bellefibre Seaborn Successor	6824	31-7-36	4	3	6,011	5.60	338.17	273
(Imp.)		9-8-37	5	3	5,858	5.84	342.34	273

C. E. KRUGER.

Camden Arachne	80635	1-7-42	2	10	5,997	6.12	367.10	273
Greenmount Golden Sultan	14688	19-6-43	3	10	7,978	6.02	480.78	273
		20-8-44	5	....	7,608	6.21	472.93	273
Camden Patsy	85543	27-6-42	3	....	5,108	6.62	338.66	273
Greenmount Golden Sultan	14688	10-6-43	3	11	6,949	6.22	432.91	273
		20-4-44	4	10	4,966	7.29	352.50	273

D. G. SPARK.

Camden Celeste	97747	15-5-46	2	8	5,202	6.09	317.24	273
Greenmount Golden Bobbie	18578	30-4-47	3	8	5,787	6.40	370.41	273
		1-5-48	4	8	7,399	6.03	446.48	273

INTERMEDIATE REGISTER OF MERIT—continued.

JERSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat (lb.)	
D. G. SPARK—continued.								
Eungella Faline	98285	24-4-46	3	....	6,769	5-56	376-70	273
Travalgan Starbright King	18129	19-5-47	4	1	8,475	5-54	470-02	273
		19-5-48	5	1	9,526	5-61	534-46	273
Juadine Peerless Lily 9th	62336	20-9-39	4	....	6,041	5-92	355-69	273
Juadine Sunshine	8212	30-10-40	5	1	7,171	5-91	424-16	273
		26-10-41	6	1	8,256	5-89	487-04	273
MRS. G. H. BURNSIDE								
Crantock Silk Socks	70901	26-6-41	4	1	6,390	5-23	334-35	240
Congelin Eminent's Golden	13623	7-5-42	4	11	6,735	5-36	361-22	273
		27-4-43	5	11	7,719	5-93	457-78	273
Glen Iris Starbright's Duchess	14176	10-9-27	4	....	6,396	5-35	342-45	273
Sweetbread's Duke of Glen Iris	1918	26-9-28	5	....	7,759	5-63	436-83	273
		24-8-29	5	11	8,043	5-66	455-86	273
D. MALCOLM.								
Dardanup Lady Fowler 13th	8986	26-6-23	2	4	7,036	4-43	312-15	273
King George of Yaralla	1271	13-7-24	3	5	7,981	5-53	441-27	273
		9-6-25	4	4	6,727	4-90	329-74	273
Sarnia Girlie	9992	17-4-22	3	5	9,038	4-78	432-78	273
Velvet Chief of Banyule	2359	20-7-23	4	9	9,180	4-85	446-01	273
		21-8-24	5	10	10,039	5-11	513-03	273
Sarnia Sheila	8452	26-8-22	1	10	6,178	5-70	352-46	273
Makarini (imp. in Dam)	995	16-10-23	3	....	5,392	6-21	334-99	273
		10-1-25	4	3	6,535	6-20	405-32	273
R. H. ROSE.								
Dardanup Lily 2nd	8946	1-2-21	3	3	6,173	5-06	312-43	273
Carnation's Masterpiece of Garden Hill	2065	10-10-22	4	11	7,933	4-92	390-16	273
		27-8-23	5	10	9,345	5-24	489-90	273
Grass Vale Daisy	8473	5-9-21	5	....	5,529	5-66	313-13	273
Starlight of Garden Hill	2339	24-8-22	5	11	7,690	5-36	413-56	273
		3-8-23	6	11	7,615	5-56	423-83	273
Grass Vale Design's Noella	98524	21-9-45	1	11	5,868	5-45	320-28	273
Mornmoot Northwood Beau	17798	12-9-46	2	11	7,660	5-32	407-64	273
		28-8-47	3	10	9,225	5-09	470-42	273
Grass Vale Eve	1679	20-2-46	2	5	6,955	6-04	420-29	273
Mornmoot Northwood Beau	17798	22-8-47	3	11	9,217	5-79	533-95	273
		27-8-48	4	11	8,802	5-88	517-38	273
Grass Vale Golden Cream 25th	92715	1-4-44	2	11	5,592	6-11	341-74	273
Grass Vale Gold Boy	14684	30-4-45	4	....	7,425	6-12	455-14	273
		30-3-46	4	11	5,341	6-07	354-62	273
Grass Vale Golden Cream 26th	98525	3-10-46	3	2	7,561	5-87	444-51	273
Mornmoot Northwood Beau	17798	29-8-47	4	1	8,677	6-18	536-92	273
		2-8-48	5	....	8,397	6-00	504-57	273
Grass Vale Golden Eve	76601	19-7-41	3	1	6,723	5-53	371-58	273
Grass Vale Gold Boy	14684	3-7-42	4	....	8,022	5-77	462-88	273
		19-9-43	5	3	8,700	5-63	489-92	273
Grass Vale Golden Maggie	81629	8-10-41	2	....	5,754	5-13	295-47	273
Grass Vale Gold Boy	14684	21-9-42	3	....	6,306	5-52	348-52	273
		4-10-43	4	....	8,229	5-50	452-98	273
Grass Vale Lady Fowler 32nd	86644	4-6-43	2	....	5,988	5-68	340-34	273
Mornmoot Northwood Beau	17798	27-8-44	3	3	8,094	5-54	448-52	237
		31-7-45	4	2	8,178	5-31	434-71	273
Grass Vale Lady Fowler 39th	1681	28-10-45	2	1	6,093	5-30	323-47	273
Mornmoot Northwood Beau	17798	17-9-46	3	....	7,468	5-26	393-21	273
		23-10-47	4	1	7,896	5-11	404-25	273

INTERMEDIATE REGISTER OF MERIT—continued.

JERSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
R. H. ROSE—continued.								
Grass Vale Magnolia 5th	98526	26-9-45	1	11	7,269	5.82	423.48	273
Grass Vale Gold Cup	20745	29-8-46	2	10	8,088	5.38	345.33	273
		8-8-47	3	10	6,525	5.04	329.01	240
Grass Vale Nora's Maid	98527	31-8-44	3	....	6,810	5.37	365.87	273
Mornmoot Northwood Beau	17798	3-7-45	3	10	7,929	5.07	402.57	273
		31-5-46	4	9	9,507	5.04	479.33	273
Grass Vale Norawood	92724	19-8-44	2	2	5,568	5.77	321.56	273
Mornmoot Northwood Beau	17798	31-7-45	3	1	7,602	5.56	423.35	273
		4-8-46	4	1	7,674	5.40	414.42	273
Grass Vale Northwood Eve	92725	1-8-44	2	1	7,755	5.81	451.23	273
Mornmoot Northwood Beau	17798	28-8-45	3	2	11,511	5.69	655.15	273
		20-9-46	4	3	10,035	5.74	576.16	273
Grass Vale Northwood Maggie	1686	3-11-46	2	1	6,967	5.14	358.53	273
Mornmoot Northwood Beau	17798	30-8-47	3	....	7,674	5.41	415.66	273
		5-8-48	3	10	7,535	5.17	390.30	273
Grass Vale Northwood Nora	86646	17-2-44	2	9	5,062	6.57	332.31	273
Mornmoot Northwood Beau	17798	3-3-45	3	9	6,627	6.37	422.72	273
		26-3-46	4	10	8,172	6.27	512.79	273
Grass Vale Silvermine 2nd	1687	16-4-46	3	7	9,129	5.64	515.57	273
Mornmoot Northwood Beau	17798	20-6-47	4	9	9,990	5.31	530.70	273
		17-7-48	5	10	10,204	5.37	548.21	273
Grass Vale Twylish Lady	76604	29-7-42	3	10	7,107	5.70	405.29	273
Grass Vale Gold Boy	14684	7-9-43	4	11	7,752	5.55	430.71	273
		21-9-44	5	11	8,232	5.55	457.48	273

W. PADBURY.

Garden Hill Wild Rose 2nd	10091	8-8-21	4	11	5,519	5.70	314.78	273
Campanile's Noble (Imp.)	860	2-9-22	6	....	7,464	5.92	441.96	273
		7-10-23	7	1	6,534	5.77	377.04	273

C. H. IRONMONGER.

Grass Vale Topsy Rye	15702	21-7-28	5	1	6,365	5.60	356.76	273
Rye Duke of Glen Iris	1994	26-6-29	6	....	6,754	5.79	391.40	273
		10-8-30	7	1	8,382	5.64	472.70	273

A. J. B. STREMPER.

Greenmount Bonnie Lass	28237	15-5-31	3	2	6,750	6.00	407.61	273
Werribee Starbright King	2602	19-5-32	4	2	6,474	5.59	360.27	273
		10-6-33	5	3	6,144	5.42	333.18	273
Greenmount Bo-Peep	20902	11-6-30	5	....	7,521	5.50	400.60	273
Werribee Starbright King	2602	17-5-31	5	11	7,206	5.15	370.65	273
		30-7-32	7	1	7,894	5.10	403.87	273
Greenmount Gentle Lady	61973	23-7-37	2	....	6,135	5.58	342.50	273
Bellefaire Bonaparte's Bonetienne	9224	30-9-38	3	2	6,223	5.79	360.47	273
		28-9-39	4	2	7,371	6.14	452.98	273
Tellaraga Marinora	6707	30-6-22	5	3	9,087	4.74	430.40	273
Retford Mariposa	896	25-5-23	6	2	10,533	5.05	531.90	273
		16-5-24	7	2	11,509	5.04	584.08	273

DEPARTMENT OF AGRICULTURE, W.A.

Banyule Silvermine 38th	18817	29-7-30	4	9	6,446	5.45	351.60	273
Wotton Airman .....	....	5-8-31	5	10	7,640	5.41	413.16	273
		4-10-32	7	....	8,753	5.20	352.13	273

INTERMEDIATE REGISTER OF MERIT—continued.

JERSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
A. G. SCOTT.								
Greenmount Golden Wonder	61975	26-7-37	2	4	6,089	5.41	329.20	273
Bellefaire Bonaparte's Bonetienne	9224	1-8-38	3	4	6,831	5.29	361.34	273
		16-8-39	4	5	8,581	5.36	460.99	273
Greenmount Sweet Lass	44204	3-1-37	3	6	6,440	5.51	354.98	273
Bellefaire Bonaparte's Bonetienne	9224	13-3-38	4	8	8,572	5.76	494.03	273
		13-3-39	5	8	7,408	5.57	412.02	273
K. V. GRAY.								
Juadine Fairy	93213	31-5-45	2	....	4,752	6.76	326.66	273
Juadine Northwood Beau	19670	27-6-46	3	1	5,835	6.33	369.62	273
		18-6-47	4	....	6,360	6.50	413.91	240
MISS L. G. HANCOCK.								
Juadine March Flower	81988	1-9-41	2	6	7,728	5.01	387.83	273
Austral Park Wonderful Standard	12423	25-9-42	3	7	9,786	5.20	509.56	273
		30-9-43	4	7	11,017	5.00	551.34	273
Juadine Peerless Lily 3rd	28188	24-9-30	2	....	5,394	5.50	296.95	273
Juadine Larry	5865	1-10-31	3	....	5,823	5.76	333.88	273
		27-9-32	4	....	7,557	5.80	443.67	273
MRS. A. G. ECKERSLEY.								
Juadine Peerless Lily 17th	81991	23-4-42	2	4	5,175	6.28	325.30	273
Austral Park Wonderful Standard	12423	21-5-43	3	5	5,965	6.35	379.32	273
		23-4-44	4	4	5,884	6.31	371.59	273
D. BRADFORD.								
Kapara Happy Days	93309	14-5-45	3	5	6,351	5.55	353.09	273
Grantham Easter Oxford	14677	21-4-46	4	5	6,939	5.16	358.32	273
		13-4-47	5	4	7,011	5.59	392.41	273
Kapara Rosebud	98310	3-6-43	2	....	6,157	5.38	331.55	273
Congelin Mandarin	14542	27-5-44	3	....	7,470	5.11	381.93	273
		2-8-45	4	2	7,053	4.85	342.52	273
Kapara Sparkle 3rd	77064	9-5-43	3	10	6,529	5.52	360.78	273
Congelin Mandarin	14542	15-4-44	4	9	7,063	4.95	349.74	273
		1-6-45	5	10	7,971	5.11	407.57	273
Kapara Sparkle's Lassie	82173	6-4-43	2	7	7,611	5.42	413.18	273
Congelin V.C.	16412	17-5-44	3	9	7,420	4.94	366.92	273
		22-5-45	4	9	6,832	5.14	351.54	273
D. J. GOYDER.								
Lirycleas Favourite	6823	7-9-20	3	7	7,173	5.24	396.18	273
Retford Mariposa	896	24-8-21	4	6	8,925	5.28	472.09	273
		25-9-22	5	7	11,462	5.01	574.23	273
Wollingurry Bright Lass	6818	31-12-20	3	9	7,540	5.05	380.62	273
Jamie of Ingleside	279	3-2-22	4	10	7,846	5.58	438.36	273
		31-1-23	5	10	11,289	4.93	556.74	273
T. H. WILDING.								
Mokine Empire Lily 5	10635	20-6-23	2	11	5,725	6.67	382.07	273
Noble's Best of Garden Hill	1756	20-5-24	3	10	5,197	6.99	363.41	273
		27-5-25	4	10	8,304	6.66	553.83	273
Mokine Fancy	8484	7-10-23	3	9	5,337	5.99	319.93	273
Noble's Best of Garden Hill	1756	11-8-24	4	7	8,641	5.83	504.47	273
		8-7-25	5	6	9,681	6.00	580.90	273

INTERMEDIATE REGISTER OF MERIT—continued.

JERSEYS—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat (lb.)	
P. ROSE.								
Moorlands Ada	23679	12-4-29	2	11	7,563	5.26	398.12	273
Colonel of Melrose	4015	12-6-30	4	1	7,776	4.99	388.25	273
		17-4-31	4	11	8,454	5.05	465.01	273
Moorlands April	23687	5-6-30	3	9	7,038	5.09	358.87	273
Colonel of Melrose	4015	10-6-31	4	9	7,908	5.46	431.24	273
		16-5-32	5	8	7,663	5.20	399.17	273
Moorlands Italy	68074	8-4-38	3	9	6,702	5.73	383.72	273
Melrose Liberty	7973	10-3-39	4	8	5,745	5.33	306.24	240
		25-3-40	5	8	7,238	5.78	418.70	273
L. M. TEMPLE.								
Radyr Park Dorothy	45844	5-10-35	4	2	6,467	5.08	328.94	273
Melrose Clarion	6931	6-10-36	5	2	6,693	4.84	325.79	273
		12-9-37	6	1	8,793	5.08	446.92	273
Radyr Park Dorothy 10th	83556	11-6-44	4	11	7,035	4.70	330.90	273
Navua Coronation Star	14929	10-6-45	5	11	8,850	4.58	406.09	273
		26-8-46	7	2	8,970	4.53	406.80	240
Radyr Park Dorothy 19th	95267	8-10-45	3	7	7,282	4.26	310.37	273
Navua Coronation Star	14929	11-9-46	4	6	8,550	4.79	409.60	273
		12-9-47	5	6	8,739	4.62	404.11	273
M. T. PADBURY.								
Rosy Hill Mars	64109	24-10-39	4	2	5,124	5.95	304.86	273
Rosy Hill Pearl's Chief	12136	15-11-40	5	3	8,013	5.15	412.13	273
		28-3-42	6	7	6,669	5.86	390.98	273
W. H. & T. F. ROBINSON.								
Springmead Josephine	42003	21-8-34	3	2	6,426	6.02	386.86	273
Bellefaiire Blonde's Corsican	7040	7-8-35	4	2	7,346	6.44	473.30	273
		29-9-36	5	4	6,761	5.99	405.28	273
Travalgan Lady Mint 8th	79294	2-7-41	2	2	6,534	5.81	379.94	273
Glen Iris Golden Oxford	12694	16-6-42	3	1	6,408	5.63	361.14	273
		2-8-43	4	3	5,805	5.64	327.42	180
Travalgan Starbright 2nd	55608	30-5-38	3	9	6,243	5.52	344.91	273
Travalgan Northern Noble	10124	25-5-39	4	9	8,445	5.45	460.87	273
		16-5-40	5	8	7,707	5.64	434.78	273
Travalgan Starbright 3rd	59778	31-5-38	2	1	6,752	5.25	354.72	273
Travalgan Northern Noble	10124	6-7-39	3	2	8,340	5.65	471.04	273
		25-5-40	4	1	7,224	5.71	412.30	273
L. C. FIELD.								
The Wold Starbright's Daisy	31179	23-5-35	4	11	8,346	5.92	505.74	273
Grantham Starbright's King	5796	4-6-36	5	11	7,256	5.37	389.76	273
		31-5-37	6	11	7,282	5.62	408.98	240
C. J. CUNNINGHAM.								
Walgett Fortune	42401	2-6-35	4	7	8,532	5.19	443.07	273
The Valley Twylish Fox	5623	9-5-36	5	6	6,911	5.03	347.66	273
		20-4-37	6	5	8,100	5.03	407.19	273
Walgett Handsome Girl	42402	5-4-35	3	4	6,114	5.77	352.88	273
Burekup Campanile's Duke	7287	8-4-36	4	4	6,092	5.57	339.69	273
		19-4-37	5	5	7,377	5.65	416.58	273

INTERMEDIATE REGISTER OF MERIT—continued.

A.I.S.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
W. G. BURGESS.								
Dahlea 5th of Berry	15545	21-3-28	4	1	7,689	4.23	325.64	273
Mirth of Berry	1716	16-2-29	5	.....	9,451	4.56	431.77	273
		14-3-30	6	1	10,086	4.31	435.13	273
Matilda 7th of Berry	14074	2-4-28	4	3	9,825	4.36	428.32	273
Rutland of Darbalara	575	11-6-29	5	8	9,970	4.58	451.30	273
		30-9-30	6	9	10,725	4.43	474.98	273
Blacklands Jeanette 7th	9324	24-8-34	3	8	9,240	4.02	371.94	273
Fussy's Monarch of Hillview	493	29-7-35	4	7	11,955	3.70	446.06	240
		19-6-36	5	6	11,391	3.93	447.49	273
Darbalara Melba 69th	17023	10-5-29	4	6	10,486	4.50	472.60	273
Re-echo of Darbalara	2254	12-7-30	5	8	11,055	4.40	486.42	273
		10-8-31	6	9	10,668	4.54	499.37	273
Virginia 20th of Darbalara	14858	2-8-27	3	11	7,530	4.26	321.25	273
Expert of Darbalara	1608	15-9-28	5	.....	10,401	4.41	459.54	273
		18-8-29	5	11	11,098	4.41	489.70	273
Kurrawong Pride 4th	16045	14-2-29	3	3	8,229	3.79	312.34	273
Premier of Kurrawong	1212	20-2-30	4	3	10,028	3.98	399.62	273
		6-6-31	5	7	10,209	3.89	390.20	273
Kurrawong Royal Lady	16049	13-11-28	3	7	9,645	4.08	393.99	273
Count Hughes of Cosy Camp	2011	16-1-30	4	9	10,635	4.00	426.05	273
		10-2-31	5	10	7,740	4.07	314.76	210
New Park Amy 7th	1865	31-1-33	3	8	10,902	3.70	409.07	273
Ruler of Greyleigh	1855	2-4-34	4	10	10,653	3.70	397.88	273
		10-3-35	5	9	10,767	3.68	396.41	273
Newstead Lovely 20th	17585	28-2-37	3	.....	11,535	4.01	462.13	273
Renown of Newstead	3077	13-3-38	4	1	10,530	4.12	433.03	273
		1-5-39	5	2	12,297	4.17	513.15	273
Norric Peggy	26939	3-7-39	4	3	10,575	4.07	429.94	273
Warwick Rufus	3595	22-6-40	5	2	9,666	4.15	400.75	273
		12-7-41	6	3	11,448	3.99	457.49	273
Tabbagong Dove 8th	7511	24-5-35	3	5	9,174	4.17	380.39	273
Parkview Reward 2nd	260	6-11-36	4	11	10,482	4.22	442.44	273
		5-4-38	6	4	10,965	4.17	456.96	273
Tabbagong Fairy 8th	7514	30-8-34	3	2	10,233	4.10	418.79	273
Parkview Reward 2nd	260	9-9-35	4	2	10,358	4.24	439.19	273
		1-9-36	5	2	10,989	4.56	471.55	273
Daphne 7th of the Hill	15697	6-9-29	3	4	8,520	4.16	354.39	273
Crescent of The Hill	2016	5-10-30	4	5	10,248	4.08	418.11	273
		4-10-31	5	6	9,267	4.36	404.87	273
Empress 4th of The Hill	15703	10-9-31	3	3	8,709	4.20	365.35	273
Crescent of The Hill	2016	20-9-32	4	4	10,821	4.30	431.56	273
		24-9-33	5	4	11,115	4.10	455.73	273
Sally of The Hill	15741	30-6-31	3	9	11,011	4.23	465.79	273
Crescent of The Hill	2016	20-6-32	4	8	12,297	4.00	497.89	273
		30-7-33	5	10	13,164	3.96	521.82	273
Tipperary Beauty 7th	33565	27-9-41	2	2	8,016	4.48	359.80	273
Wooroloo Melba's Triumph	4491	27-9-42	3	2	7,989	4.47	357.25	273
		1-11-43	4	3	8,628	4.34	374.48	273
Tipperary Beauty 9th.	40631	8-10-43	3	8	7,290	4.12	300.58	273
Blacklands Monarch's Commander	1877	6-1-45	4	11	9,246	4.32	399.86	273
		14-4-46	6	2	10,809	4.26	461.40	273
Tipperary Fairy III.	22905	29-9-38	2	1	8,664	4.28	370.56	273
Blacklands Monarch's Commander	1877	27-10-39	3	2	9,438	4.28	403.58	273
		4-1-40	4	4	11,721	4.23	495.76	273
Tipperary Maggie IV.	18330	17-7-39	3	10	10,206	4.22	430.90	273
Blacklands Monarch's Commander	1877	22-8-40	4	11	10,311	4.37	451.18	273
		1-9-41	6	.....	11,259	4.25	478.64	273

INTERMEDIATE REGISTER OF MERIT—continued.

A.I.S.—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
W. G. BURGES—continued.								
Tipperary Sally	18338	8-5-37	2	1	7,452	4.18	311.14	273
Blacklands Monarch's Commander	1877	26-5-38	3	1	8,256	4.00	330.65	273
		26-5-39	4	1	10,929	3.82	417.02	273
Tipperary Beauty II.	18314	8-8-38	4	4	11,499	4.10	471.59	273
Blacklands Monarch's Commander	1877	27-7-39	5	4	12,003	4.19	502.72	273
		25-7-40	6	4	11,964	4.20	503.67	273
Tipperary Beauty III.	18315	2-8-37	2	4	7,287	4.22	307.62	273
Blacklands Monarch's Commander	1877	18-8-38	3	4	9,459	4.31	407.99	273
		24-11-39	4	8	7,776	4.49	349.11	273
Limelight's Camellia of Wangara	17879	17-12-29	2	5	8,250	4.26	351.49	273
Limelight of Darbalara	1105	26-2-31	3	7	9,273	4.10	381.04	273
		19-4-32	4	9	10,464	4.20	429.55	273
Widgee Waa Rosy 5th	5117	18-10-32	2	6	9,252	3.80	359.21	273
Park View Mayflower's Monarch	2049	5-11-33	3	7	11,412	3.97	453.32	273
		17-10-34	4	6	11,392	4.04	461.53	273

E. McMANUS.

Gentle of Blackheath	11679	13-10-24	5	1	9,903	4.49	445.02	273
Flower's Mayfield of Blackheath	370	5-9-25	5	11	9,740	4.07	396.48	210
		22-11-26	7	2	11,748	4.10	481.84	273
Homeleigh Treasure 3rd	14950	27-9-22	2	9	8,805	4.34	382.87	273
Defender of Homeleigh	944	21-10-23	3	9	8,829	4.68	413.77	273
		19-1-25	5	....	9,924	4.88	484.99	273

A. E. GRANT.

Flash of East View	18331	7-12-31	3	2	8,145	3.80	305.44	273
Mariner of Greyleigh	587	21-3-33	4	5	10,236	4.10	418.66	273
		16-4-34	5	7	12,871	4.12	531.04	273
Victress of Toora	17887	20-8-30	2	5	7,455	4.63	345.30	273
Victor of Darbalara	2384	12-8-31	3	5	9,642	4.65	448.19	273
		9-8-32	4	5	10,074	4.70	475.48	273
East View Lucky Pretty Maid 3rd	8481	28-10-28	4	....	9,511	4.19	398.80	273
East View Lucky Boy	599	14-12-29	5	1	8,254	4.54	374.89	273
		10-3-31	6	4	13,921	4.00	557.63	273

D. BEVAN & SONS.

Gold of East View	10940	14-1-31	4	9	12,675	4.01	508.73	273
Mariner of Greyleigh	587	21-4-32	6	....	11,102	3.90	436.32	273
		14-8-33	7	3	14,055	3.47	488.05	273
Glanavon Buttercup	25158	17-9-38	2	5	6,216	5.01	311.42	273
Blacklands Jean's Supreme	1871	1-3-40	3	10	8,220	4.82	395.93	273
		17-2-41	4	10	8,757	4.78	418.54	273
Glanavon Buttercup 3rd	30578	6-2-41	2	5	9,429	3.98	375.32	273
Glanavon Golden Boy	4830	22-8-42	3	11	9,276	3.85	357.66	273
		10-10-43	5	1	10,166	3.99	405.85	273
Glanavon Charmer	25160	13-7-39	2	3	6,372	4.54	289.33	273
Parkview Commodore	306	14-12-40	3	8	9,645	4.39	423.99	273
		22-12-41	4	8	11,244	4.20	472.42	273
Glanavon Cowslip 5th	36532	2-7-40	1	8	6,969	4.32	300.94	273
Parkview Commodore	306	31-7-41	2	9	9,894	4.16	412.53	273
		29-9-42	3	11	10,209	3.96	405.12	273
Glanavon Dahlia 9th	30582	1-7-41	2	5	9,827	4.13	406.05	273
Glanavon Golden Boy	4830	4-5-42	3	3	8,778	4.12	362.40	273
		25-8-43	4	7	8,871	4.01	355.83	273
Glanavon Dell 4th	30583	17-7-41	3	4	10,437	4.03	420.43	273
Glanavon Elliott	3955	18-7-42	4	4	11,061	3.92	433.86	273
		12-7-43	5	4	9,465	3.83	362.87	273

INTERMEDIATE REGISTER OF MERIT—continued.

A.I.S.—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat (lb.)	
D. BEVAN & SONS—continued.								
Glanavon Doris V.	25170	14-1-39	2	2	6,798	4.09	278.09	273
Blacklands Jean's Supreme	1871	7-12-39	3	....	9,387	4.52	424.09	273
		26-12-40	4	1	13,443	4.62	620.66	273
Glanavon Fairy	20204	19-6-39	4	6	10,131	4.09	415.19	273
Blacklands Jean's Supreme	1871	13-8-40	5	8	17,583	3.92	688.60	273
		22-10-41	6	10	13,689	4.15	568.60	273
Glanavon Glenys	30591	2-8-41	1	10	8,751	3.96	346.79	273
Tipperary Resident	5335	27-8-42	2	10	9,171	4.05	372.32	273
		23-9-43	3	11	9,726	3.89	378.36	273
Glanavon Gold III.	25181	14-10-39	3	2	9,246	4.14	383.17	273
Glanavon Le Nayler	3201	18-10-40	4	2	9,759	4.09	399.89	273
		26-1-42	5	5	9,480	4.19	397.92	273
Glanavon Lulu	25183	26-1-40	3	3	9,300	4.54	422.41	273
Blacklands Jean's Supreme	1871	10-4-41	4	6	12,306	4.48	551.47	273
		12-5-42	5	7	11,558	4.33	500.94	273
Glanavon Mayflower	25184	7-8-39	2	3	7,506	3.74	280.21	273
Parkview Commodore	306	21-2-41	3	10	11,082	3.91	433.35	273
		26-7-42	5	3	9,153	3.72	341.02	273
Glanavon Melba	25185	11-3-40	3	3	11,631	3.85	438.11	273
Parkview Commodore	306	3-7-41	4	6	12,816	3.74	479.58	273
		15-6-42	5	6	12,327	4.03	497.77	273
Illawah Lex III.	11797	26-1-37	3	11	9,282	3.63	336.56	273
Illawah Veteran's Hope	822	28-3-38	5	1	9,912	3.58	356.66	273
		3-7-39	6	5	10,983	3.75	412.31	273
Leylands Topsy	17182	18-11-35	2	7	11,226	4.15	465.69	273
Parkview Commodore	306	19-10-36	3	6	9,450	3.79	358.20	210
		14-9-37	4	5	11,670	3.74	436.77	273
Picture 8th of Raleigh	17524	5-12-31	4	7	10,608	3.80	384.74	273
Union Jack of Raleigh	2375	19-3-33	5	11	10,710	3.90	396.82	273
		20-6-34	7	2	11,677	3.84	448.83	273
Venus 8th of Raleigh	17540	24-9-31	3	8	9,795	3.64	357.11	273
Royal Standard of Darbalara	2908	16-10-32	4	8	8,370	3.90	323.78	240
		26-9-33	5	8	11,996	3.60	431.58	273
PROWSE BROS.								
Lemon Grove Fussy 6th	17144	2-4-37	3	11	8,847	4.03	357.91	273
Aine Bank Lady's Gift	760	5-5-38	5	....	9,146	3.94	359.98	273
		15-6-39	6	1	10,551	4.00	422.73	273
M. H. MONTGOMERY.								
Montaro Princess	52256	7-11-46	2	4	8,529	4.22	360.39	273
Glanavon Tudor	8123	20-11-47	3	5	10,074	3.96	399.70	273
		6-12-48	4	5	12,465	4.09	510.24	273
E. T. THATCHER.								
The Pine's Bell	4079	16-7-35	4	10	9,480	3.89	368.72	273
Democrat of Aine Bank	1625	21-7-36	5	10	9,216	4.01	389.86	273
		27-8-37	7	....	8,603	4.58	394.51	273
BURKITT & BROWN.								
Westby Lupin III.	18516	23-10-37	3	2	8,549	4.09	349.45	273
Telyarup Duke	956	14-9-38	4	....	10,629	3.94	419.27	273
		11-9-39	5	....	9,443	3.83	362.02	273

INTERMEDIATE REGISTER OF MERIT—continued.

A.I.S.—continued.

Name of Cow ; Name of Sire.	Herd Book No.	Date Beginning of Record.	Age.		Production Records.			Days.
			Years.	Months.	Milk. (lb.)	%	Butter-fat. (lb.)	
J. BENSTED & CO.								
Valliere Dairymaid	47673	8-4-46	2	....	9,222	3.81	352.65	273
Valliere Skipton	7595	17-6-47	3	2	9,540	3.91	363.60	213
		1-5-48	4	1	11,206	3.96	443.96	273
BAYLEY BROS.								
Westby Lupin	15138	1-8-35	3	4	10,714	4.08	428.64	273
Telyarup Duke	956	23-7-36	4	4	11,947	3.87	462.28	273
		1-8-37	5	4	13,909	3.71	515.45	273
WOOROLOO SANATORIUM FARM.								
Wooroloo Betty 2nd	7734	14-5-33	2	6	9,215	4.40	406.47	273
Triumph of Pine Creek	2515	3-8-34	3	9	10,633	4.30	455.74	273
		8-9-35	4	10	9,276	4.19	388.60	273
Wooroloo Bloomer	5218	28-3-34	3	6	7,924	4.25	337.50	273
Triumph of Pine Creek	2515	4-5-35	4	7	11,039	4.53	493.32	273
		2-4-36	5	6	8,280	4.35	360.71	273
Wooroloo Dainty 2nd	28634	2-12-41	3	9	11,625	4.21	490.20	273
Parkview Guardian	2557	26-4-43	5	2	11,418	4.06	463.61	273
		2-9-44	6	6	13,080	4.50	589.00	273
Wooroloo Dell	18628	7-2-37	2	4	9,142	3.78	346.30	273
Parkview Guardian	2557	8-4-38	3	6	8,742	4.15	362.49	273
		18-3-39	4	5	10,419	4.01	418.10	273
Wooroloo Empress	23241	23-3-39	3	5	8,681	4.13	358.16	273
Parkview Guardian	2557	7-5-40	4	6	9,672	4.14	400.05	273
		16-5-41	5	7	10,671	4.11	438.14	273
Wooroloo Freda II.	23245	29-4-40	4	7	8,589	4.11	353.02	273
Parkview Guardian	2557	4-5-41	5	7	10,398	4.09	425.43	273
		20-6-42	6	9	12,135	3.94	478.66	273
Wooroloo Heather	23247	9-8-41	3	9	8,970	3.93	353.05	273
Parkview Guardian	2557	11-9-42	4	10	8,190	4.23	347.04	240
		20-9-43	5	11	11,772	4.28	503.96	273
Wooroloo Joy II.	23251	24-8-37	2	1	6,854	4.43	303.58	273
Parkview Guardian	2557	10-1-39	3	6	8,272	4.06	336.19	273
		10-3-40	4	8	9,905	4.17	413.19	273
Wooroloo Moss Rose IV.	23259	8-10-38	3	6	8,139	4.61	375.54	273
Triumph of Pine Creek	2515	10-12-39	4	8	7,896	4.61	364.43	273
		15-12-40	5	8	7,809	4.69	366.53	273
Wooroloo Red Rose 2nd	2522	12-12-31	2	6	6,896	4.64	320.59	273
Triumph of Pine Creek	2515	19-5-33	3	11	7,605	4.50	339.43	273
		22-6-34	5	....	11,352	4.46	506.31	273
Wooroloo Red Rose 3rd	5226	2-2-33	2	4	6,325	4.92	310.92	273
Triumph of Pine Creek	2515	3-5-34	3	7	7,743	4.69	363.62	273
		9-6-35	4	8	8,217	4.84	387.45	273
Wooroloo Rose 2nd	2523	1-3-33	3	10	9,042	4.50	417.85	273
Triumph of Pine Creek	2515	22-5-34	5	1	12,033	4.50	542.58	273
		1-9-35	6	4	11,796	4.74	558.46	273
Wooroloo Rosebud 3rd	33999	20-7-43	4	2	9,030	4.24	383.25	240
Parkview Guardian	2557	20-5-44	5	....	11,649	4.50	524.74	273
		12-5-45	5	11	12,184	4.41	537.37	273

STATE RECORDS AT 30th JUNE, 1950*.

Age Class.	Breed.	Name of Cow.	Milk (lb.).	Average Test (%).	Butter-fat (lb.).	Owner.	Year of Record.
ALL BREEDS.							
Mature	Guernsey	Koojan Ace's Jewel 2nd	14540	5.51	801.16	A. W. Padbury	1941
Senior, 4 years	Jersey	Radline Peerless Lily 13th	11382	6.45	734.47	Miss L. G. Hancock	1944
Junior, 4 years	Guernsey	Koojan Ace's Jewel 2nd	13169	5.19	683.45	A. W. Padbury	1940
Senior, 3 years	Guernsey	Denmark Ace's Velvet	11443	6.54	748.93	Denmark Research Station	1949
Junior, 3 years	Jersey	Grass Valley Northwood Eve	11511	5.69	655.15	R. H. Rose & Son	1946
Senior, 2 years	Guernsey	Koojan Ideal's Jewel	12397	5.30	657.65	A. W. Padbury	1941
Junior, 2 years	Jersey	Carydale Royal Princess	8611	6.07	522.98	G. Layman	1947
365 DAYS—ALL BREEDS.							
Mature	Jersey	Camden Ariadne	12975	7.00	908.85	C. E. Kruger	1948

* These are also the records for Western Australian bred cows.

STATE RECORDS AT 30th JUNE, 1950.

Age Class.	Name of Cow.	Milk (lb.).	Average Test (%).	Butterfat (lb.).	Owner.	Year of Record.
JERSEY.						
Mature	Camden Ariadne	10869	6.94	754.37	C. E. Kruger	1948
Senior, 4 years	Juadine Perless Lily 13th	11382	6.45	734.47	Miss L. G. Hancock	1944
Junior, 4 years	Camden Ariadne	8764	6.84	600.32	C. E. Kruger	1945
Senior, 3 years	Juadine Perless Lily 13th	10364	6.25	648.60	Miss L. G. Hancock	1943
Junior, 3 years	Grass Vale Northwood Eve	11511	5.69	655.15	R. H. Rose & Son	1946
Senior, 2 years	Carydale Royal Princess	9769	5.43	530.57	G. Layman	1948
Junior, 2 years	Carydale Royal Princess	8611	6.07	522.98	G. Layman	1947
GUERNSEY.						
Mature	Koojan Ace's Jewel 2nd	14540	5.51	801.16	A. W. Padbury	1941
Senior, 4 years	Koojan Dairie	10036	5.71	573.94	A. W. Padbury	1930
Junior, 4 years	Koojan Ace's Jewel 2nd	13169	5.19	683.45	A. W. Padbury	1940
Senior, 3 years	Denmark Ace's Velvet	11443	6.54	748.93	Denmark Research Station	1949
Junior, 3 years	Denmark Jonquil	8812	5.72	504.22	Denmark Research Station	1944
Senior, 2 years	Koojan Ideal's Jewel	12397	5.30	657.65	A. W. Padbury	1941
Junior, 2 years	Marrivale Vera	7450	6.85	510.78	W. J. Smith	1949
AUSTRALIAN ILLAWARRA SHORTHORN.						
Mature	Blackland's Ettie 9th	17523	4.43	776.91	D. Bevan & Sons	1940
Senior, 4 years	Hope 3rd of The Hill	13423	4.44	606.00	W. G. Burges	1930
Junior, 4 years	Glanavon Doris 5th	13443	4.62	620.66	D. Bevan & Sons	1941
Senior, 3 years	Glanavon Tiny 5th	14322	4.27	612.11	D. Bevan & Sons	1942
Junior, 3 years	Glanavon Dahlia 7th	13035	4.41	575.57	D. Bevan & Sons	1942
Senior, 2 years	Glanavon Tiny 5th	13530	4.30	581.95	D. Bevan & Sons	1941
Junior, 2 years	Valliere Nina	10611	4.34	460.64	C. P. House	1947

STATE RECORDS AT 30th JUNE, 1950.

WESTERN AUSTRALIAN BRED.

Age Class.	Breed.	Name of Cow.	Milk (lb.).	Average Test (%).	Butterfat (lb.).	Owner.	Year of Record.
Mature	Guernsey	Koojan Ace's Jewel 2nd	14,540	5.51	801.16	A. W. Padbury	1941
Senior, 4 years	Jersey	Juadine Peerless Lily 13th	11,382	6.45	734.47	Miss I. G. Hancock	1944
Junior, 4 years	Guernsey	Koojan Ace's Jewel 2nd	13,169	5.19	683.45	A. W. Padbury	1940
Senior, 3 years	Guernsey	Denmark Ace's Velvet	11,443	6.54	748.93	Denmark Research Station	1949
Junior, 3 years	Jersey	Grass Vale Northwood Eye	11,511	5.69	655.15	R. H. Rose & Son	1946
Senior, 2 years	Guernsey	Koojan Ideal's Jewel ...	12,397	5.30	657.65	A. W. Padbury	1941
Junior, 2 years	Jersey	Carydale Royal Princess	8,611	6.07	522.98	G. Layman	1947

SIX HIGHEST PRODUCING COWS IN EACH BREED (to 30/6/50).

Name of Cow.	Herd Book No.	Age Classification at time of Record.	Milk (lb.).	Average Test (%).	Butter-fat (lb.).	Owner at time of Record.	Sire.
JERSEY.							
Camden Ariadne	85538	Mature	10869	6.94	754.37	C. E. Kruger	Greenmount Golden Sultan (14688)
Congelin Iolanthe 8th	80825	Mature	13215	5.57	737.19	D. Bradford	Rosediffe Marchalong (15094)
Juadine Peerless Lily 13th	76977	Senior, 4	11382	6.45	734.47	Miss L. G. Hancock	Austral Park Wonderful Standard (12423)
Grass Vale Silvermine 2nd	1687	Mature	13131	5.59	734.23	R. H. Rose & Son	Mormoot Northwood Beau (17798)
Mokine Beauty	94437	Mature	11790	5.89	694.74	T. H. Wilding	Erwin Royal Volunteer (16941)
Banyule Silvermine 55th	25473	Mature	11759	5.76	677.97	Department of Agriculture, Vale	Air Lord of Banyule (3337)
GUERNSEY.							
Koojan Ace's Jewel 2nd	5661	Mature	14540	5.51	801.16	A. W. Padbury	Homestead Ace (Imp.) (1631)
Denmark Ace's Velvet	12672	Senior, 3	11443	6.54	748.93	Denmark Research Station	Denmark Ace (5738)
Koojan Ace's Jewel	4333	Mature	12885	5.14	662.15	A. W. Padbury	Homestead Ace (Imp.) (1631)
Koojan Ideal's Jewel	7251	Senior, 2	12397	5.30	657.65	A. W. Padbury	Glenburne Ideal (Imp.) (2548)
Denmark Orangebud	4123	Mature	12198	5.16	629.93	Denmark Research Station	Koojan Golden Prosper (2283)
Koojan Golden Butterfly	4339	Mature	11229	5.48	615.43	A. W. Padbury	Koojan Ace (2270)
AUSTRALIAN ILLAWARRA SHORTHORN.							
Blacklands, Ettie 9	9298	Mature	17523	4.43	776.91	D. Bevan & Sons	Parkview Limestone (370)
Glanavon, Fairy	20204	Mature	17583	3.92	688.60	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Yallah Farm, Maggie 2nd	1272	Mature	17541	3.86	677.21	W. G. Burges	Fussie's Favo of Park View (2149)
Glanavon, Bessie	30603	Mature	13410	4.82	647.54	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Gentle of Blackheath	11679	Mature	16669	3.80	633.24	E. McManus	Flowers' Mayfield of Blackheath (370)
Leylands, Melba	17170	Mature	14451	4.37	631.66	D. Bevan & Sons	Widge Waa Record (848)

MERIT BULL LIST.

Name of Bull.	Breed.	Herd Book Number.	Intermediate Register of Merit.		Lifetime Register of Merit.		Total Daughters in Register of Merit.			Total Number.	Daughter's Total Lactations.	Recorded Average Butterfat (lb.).
			Daughters.	Average Butterfat (lb.).	Daughters.	Average Butterfat (lb.).	Daughters.	Lactations.	Average Butterfat (lb.).			
Greenmount Golden Sultan	Jersey	14688	2	407.41	2	460.54	4	17	441.81	10	27	402.63
Mormon Northwood Beau	Jersey	17798	11	442.93	1	498.17	12	38	450.50	36	90	401.79
Dennick Daxton	Guernsey	12510	3	394.30	1	369.26	4	17	370.25	36	90	314.54
Honest Ace	Guernsey	1631	6	485.80	5	397.46	11	49	429.32	37	98	396.13
Kodak Golden Prosper	Guernsey	2283	2	446.73	9	371.62	11	80	377.26	37	125	350.49
Norrah Robin	Guernsey	417	2	429.59	4	448.84	6	30	411.26	17	97	389.14
Blacklands Joan's Supreme	A.I.S.	1871	4	466.39	2	453.34	6	24	459.83	51	76	343.82
Blacklands Monarch's Commander	A.I.S.	1877	6	410.77	2	459.23	8	18	448.35	34	76	338.45
Crescent of The Hill	A.I.S.	2016	8	435.05	2	459.23	5	20	448.35	8	28	354.31
Parkview Commodore	A.I.S.	306	5	402.33	1	384.06	8	15	402.33	46	89	353.83
Parkview Guardian	A.I.S.	2557	7	420.28	1	384.06	8	27	412.21	47	119	353.83
Triumph of Pine Creek	A.I.S.	2515	6	405.61	1	403.54	7	24	405.09	40	92	334.84

Sire Merit Lists.

The standard of entry to the Merit list of sires is:—

- (a) Five daughters in the Intermediate Register of Merit; or
- (b) three (3) daughters in the Lifetime Register of Merit; or
- (c) four daughters distributed in the Intermediate and Lifetime Registers of Merit, i.e., two (2) in the Intermediate plus two (2) in the Lifetime Register; or three (3) in the Intermediate and one (1) in the Lifetime Register.

Since there are a number of ways of computing a Sire Merit List and the method to be used in this State has not been finally determined a further table has been added. In it all bulls are shown which have sired ten or more daughters each of which has production of 400 lb. or over in a 273 day lactation, uncorrected for age.

Name of Bull.	Breed.	No. of Daughters reaching Standard (400 lb.).	No. of Lactations over 400 lb.	Average of Lactations over 400 lb.
Homestead Ace	Guernsey	20	48	479.35
Koojan Ace's Warspite	Guernsey	10	13	451.81
Koojan Golden Prosper	Guernsey	13	35	462.36
Blacklands Jean's Supreme	A.I.S.	10	23	474.88
Parkview Guardian	A.I.S.	18	31	462.94
Austral Park Wonderful Standard	Jersey	11	22	510.24
Grass Vale Gold Boy	Jersey	11	18	466.35
Mornmoot Northwood Beau	Jersey	22	46	479.78

The Destruction of Rabbits

With Notes on Methods of Destroying Emus, Kangaroos, Mice, Rats
and Wedgetailed Eagles

by

A. R. TOMLINSON, Chief Vermin Control Officer.

J. S. CRAWFORD, Senior Inspector, Vermin Control Branch.

FOREWORD

Some of the materials and implements mentioned are in short supply or even unobtainable. They have been included in the hope that supplies will be more readily available in the future. In the meantime alternative methods, which are recommended, may be used with success.

THE RABBIT VIRUS.

No mention has been made of the rabbit virus (myxomatosis) which has attained so much prominence recently.

However, indications are that the virus may possibly be used in favourable localities in conjunction with established methods of control rather than to supplant them.

Landholders will still be expected to continue with the work of destroying rabbits on their properties and vermin boards should not relax in the enforcement of rabbit destruction measures.

A. R. TOMLINSON, Chief Vermin Control Officer.

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INTRODUCTION ON THE RABBIT PROBLEM

Rabbits are firmly entrenched in Western Australia and at all times are capable of increasing to plague proportions with seasonal conditions favourable to their breeding. If suitable food and water supplies are available, they will breed right throughout the year. As the gestation period is only 28 days and maturity is reached in about three months, it is evident that the rate of reproduction is enormous. It has been calculated that, theoretically, one pair of rabbits could multiply to 13,000,000 in three years.

Naturally so many outside factors are normally encountered that this figure is greatly reduced, but the fact remains that the potential danger is always present and will be present as long as rabbits are with us.

Experience, in other places as well as in Western Australia, has shown that methods of control and destruction differ according to local conditions and seasonal variations. Nevertheless one thing is certain and that is the only sure method is a constant and unrelenting attack which must be carried out all the year round as a routine farm practice.

The recognised methods of control and destruction may be listed as follows:—

(1) **Fencing**, which is the only way by which complete exclusion of rabbits and protection of properties may be obtained.

Unfortunately, availability of materials and finances are restricting factors, but, when and where possible, fencing should be the first step taken. It should never be forgotten, however, that once a fence is erected any rabbits already inside must be eliminated and every care must be taken to maintain the fence in a rabbit-proof condition.

(2) **Destruction of cover**, which entails the removal of all surface harborage, and digging, ploughing, ripping or otherwise destroying burrows. This measure is most important as rabbits are easier to destroy in the open and the destruction of their cover interferes with breeding activities.

(3) **Fumigation** of warrens which is used as an alternative to destruction of cover.

(4) **Poisoning** which, as a most effective way of mass destruction as well as for dealing with smaller numbers, is a method which may and should be employed throughout the year. Different materials and poisons may be required for different seasons, but poisoning in some form or other is possible in most localities throughout practically all the year.

(5) **Shooting, trapping** and using **dogs, ferrets, etc.**, are all ranked as being of minor importance and, to be effective, should only be used in conjunction with any of the measures mentioned previously. When used by themselves—particularly trapping by professionals—these minor methods have sometimes been found to do more harm than good.

Nature has supplied rabbits with an excellent protective armour in their timidity and suspicion which form the basis of their adaptability to new conditions and dangers. For success to be achieved in rabbit destruction, these instincts must be recognised and overcome.

Suspicion must be countered in poisoning and fumigating by the adoption of special measures which are described later.

Timidity leads the rabbits to conceal themselves in logs and scrub, etc., while, if there is no surface cover present, they will dig burrows and warrens. By the removal or destruction of these protections, the rabbits are forced into the open where they are more vulnerable to attacks by their natural enemies as well as to the measures used against them by man.

It must be recognised that the control of any vermin is not an easy matter and requires continuous work and expenditure. There can be no doubt, however, that if the methods of protection from, and destruction of, rabbits recommended by the Department of Agriculture, are adopted as routine farm practices, damage and losses caused by the pest will be reduced to a minimum.

RABBIT TRAPPING

The value of rabbit carcasses and skins exported overseas and marketed locally each year is a very big figure. Practically all of these rabbits are taken from farming properties where their presence has meant a proportionate reduction in crops and stock. It is obvious that the returns going to the rabbit carcase and skin trade are really the losses which have accrued to the farmers on whose crops and pastures the rabbits were raised. In other words, no matter how high the rabbit industry is valued, it in no way compensates for the tremendous loss in export production of staple primary products which the rabbits have caused.

The commercialisation of a pest such as the rabbit must be to the ultimate detriment of the pastoral and farming industries. The interests of the rabbit skin and carcase marketing organisations are completely opposed to the interests of the primary producers. The farmers are growing crops for marketing or raising stock on the pastures they grow. They wish to eradicate rabbits to protect their crops and increase the stock carrying capacity of their pastures. The professional trappers are aiming at obtaining the maximum number of rabbits possible. Their business is the raising and marketing of rabbits even if it is on the properties of the farmers and at the expense of the farmers. Obviously they do not wish for the eradication of rabbits which would be doing away with their means of livelihood.

Professional trappers will not waste their time on "smalls" and does if they can avoid doing so. They are mainly interested in the bucks which are the most marketable. As soon as the catch becomes unprofitable to them, they move on to other properties until the rabbits return and breed up again. Although some rabbits will be caught by trapping, others will be frightened away, giving the impression that complete eradication has been obtained. Quite often when the rabbits return, the farmers think that an invasion from neighbouring properties has occurred.

It is not denied that the activities of professional trappers will reduce the numbers of rabbits on a property temporarily and that in some localities, close to large towns and within range of the metropolitan area, trapping by amateurs and week-end trappers as well as by professionals has assisted in controlling the pest. Nor

can it be denied that the cost to the owner of "farming" the rabbits will be much heavier than if he had kept the rabbits under control by other means such as warren destruction, fumigating or poisoning. One estimate made is that the cost to a farmer of "farming" rabbits is six times greater than the cost of control or destruction.

The whole matter of professional trapping may be summed up in the question—"Which is the more profitable between rabbits and crops or stock from the viewpoint of the farmers individually and the State generally?" The answer is so obvious that the question may appear ridiculous, but it is a question which many farmers should ask themselves.

RABBIT CONTROL AND DESTRUCTION

FENCING.

Specifications.—Fences, properly constructed with rabbit-proof netting and adequately maintained, are the only safe means of keeping rabbits away from a property. The standard rabbit-proof fence has 1½ in. mesh netting, 42 in. in width with 6 in. underground. One plain wire is about 22 in. above the ground, and another 36 in. above the ground to both of which the netting is fixed. A barbed wire is placed about 10 in. above the netting, although plain wire is sometimes used. Posts are not more than 18 ft. apart.

Subdivision of Large Areas.—Cleared portions of a property should be netted in from uncleared sections. Boundary fences should be erected first (on cleared country), but on large holding, subdivisions are necessary. Even though a property is netted, any rabbits which are already present or which might enter (through washed out or burnt fences or opened gates) must be dealt with.

Maintenance.—Of equal or even greater importance is the necessity for keeping the property rabbit-proof after the fence has been erected. Constant vigilance is required to ensure that the netting is kept in good repair; water or wind erosion does not leave openings; gates are closed and close fitting with adequate bed logs; burrows are not made underneath and that any other means of entry is blocked.

Advantages.—The important aspect is that the owner of a rabbit-proofed property is dealing only with his own rabbits and not with those from outside. He knows that, as long as he maintains the effectiveness of his fence, he is safe from plagues and large scale movements. He should have no difficulty in keeping any rabbits on the property under control even to the extent of complete extermination.

DESTRUCTION OF WARRENS AND BURROWS.

The elimination of all cover which may harbour and protect rabbits ranks very high in rabbit control. The destruction of warrens and burrows is an essential feature of this work and must be undertaken where at all possible.

Necessity for Methodical Work.—To obtain the maximum success, it is most important that the warrens be dealt with methodically. The rabbits' main protection—instinctive suspicion and timidity—must be countered. Every care must be taken to ensure that no openings are missed and that the work on each warren is completed

before commencing on the next. On no account should a warren be left unfinished overnight as all the rabbits will escape before the morning.

Advisability for Poisoning.—When a property is badly rabbit infested and warrens are numerous, a good poisoning before commencing warren destruction is advisable.

Digging In, Ploughing or Crushing Warrens.—Small warrens may be dug by hand, using mattocks, picks, shovels, etc. To do a more effective or large scale job, however, deep ploughing and ripping with the aid of tractors are recommended. Deep ploughing may be accomplished with a dam sinking plough or a two or three furrow mouldboard plough with the "boards" removed. Cane rippers and similar implements are being used with great success, particularly those with the tynes controlled by the tractor operator.

Digging Out.—The actual digging out of warrens is a slow and laborious procedure which is not recommended if other methods are possible. If digging out is undertaken it is advisable to use a pack of dogs in conjunction. As rabbits are driven to the surface the dogs will attend to them.

After Treatment.—After the warrens have been destroyed, no matter by what means, it is of utmost importance that the ground should be levelled off immediately. If the time of the year is favourable and particularly if in a pasture, the area treated should be resown with grasses. This will assist against soil erosion and will also discourage fresh rabbits from reburrowing.

Fumigation.—A week or so after the completion of warren destruction, the sites should be examined for any openings from either the outside or inside. All holes found should be fumigated, filled, and levelled off.

FUMIGATION.

The complete destruction of all warrens and burrows should be the aim of every landholder if rabbits are to be kept under control. Unfortunately, various factors, such as creek and river banks and steep hills, may prevent the achievement of this aim and fumigation, in conjunction with poisoning, is the alternative.

Fumigation in Conjunction with Warren Destruction.—Fumigation is often necessary as a follow-up measure after warren destruction. Visits should be paid to the sites of destroyed warrens and any openings made by rabbits fumigated and filled in.

Time of the Year to Fumigate.—Fumigation is usually employed in winter when the moisture in the ground renders the soil less porous and thus retards the escape of the fumigants. Furthermore, in winter and spring months breeding is at its maximum.

Introducing Fumigants to the Warrens.—Naturally some method of introducing the fumigants into the burrows or warrens must be used. The methods vary from pieces of old bags or cloth soaked in chemicals, injectors which squirt liquid, pumps and blowers which propel chemicals or gases down the openings and generators which manufacture the poisonous gases and then force them into the burrows.

In all cases the primary object is to make the fumigant used penetrate into every part of the warren and thus ensure that any rabbits which have retreated to the deepest points will be killed. It will be seen that for this reason gases, which are heavier than the air, have an advantage over those which are lighter. The former will flow downwards and will remain for some time. The latter will go down only as far as they are forced and will rise as soon as the pressure is relaxed.

General Directions.—Care must be taken to ensure that every warren receives a sufficient quantity of fumigant. When visible gases are used under pressure, this may be ascertained by noting (and sealing up) each opening from which gas is being expelled. This will indicate that the warren has been filled with the fumigant. Any openings which are still clear will not be connected with the warren being dealt with and will require separate treatment. With invisible fumigants it is necessary for some to be introduced into every opening unless it is possible to establish without doubt that the burrows are connected.

If all openings are filled about a week before fumigating, only those which have been re-opened need to be treated.

After treatment, all openings should be filled in as far down as possible, taking care not to cover any fumigant which has been inserted. If earth is heaped on top, the work of any rabbits attempting to escape will be made more difficult.

Types of Fumigants Recommended.—The only fumigants which are recommended are those containing poisonous gases such as carbon-bisulphide, carbon-monoxide, chloropicrin and cyanide. All of these require about the same concentration for fumigation purposes.

CARBON-BI-SULPHIDE.

This is obtainable in a liquid form and gives off a highly poisonous, heavier-than-air gas. (It is $2\frac{1}{2}$ times heavier than air.)

Application.—The gas may be introduced by pushing bagging, cloth, etc., soaked in the liquid as far down the burrows as possible. Care must be taken not to cover the material when the opening is closed. Special machines or fumigators in the form of pumps are manufactured for forcing the fumes into warrens.

Special Instructions.—In both the liquid and gaseous forms, carbon-bi-sulphide is highly inflammable and explosive. Containers should be stored in cool places and every care taken to ensure that flames or naked lights of any type are not allowed near when storing, carrying or using this fumigant. Exposure to heat may be dangerous.

The practice, adopted sometimes, of throwing a match down a treated burrow to explode the fumes is highly dangerous, ineffective and uneconomical.

Any liquid left in an appliance after a day's fumigation should be poured back into the container and tightly secured.

Leather plungers or washers which come in contact with the liquid should be removed each night and soaked in harness or neats-foot oil. Otherwise they will perish rapidly.

CARBON-MONOXIDE.

This fumigant is produced by the action of heat on air. The most successful means of generating it is by drawing air through a compact glowing mass of charcoal, etc., such as in a gas producer. Carbon-monoxide is contained in the exhaust fumes from motor vehicles but the proportion is very low compared with those from gas producers. The use of exhaust fumes alone is not as effective as other means.

While gas producer fumigators have the disadvantage of being heavier to handle than other machines, they have the advantage of economy. After the machine has been bought, the only other expenditure should be for charcoal.

Sometimes wood or rubbish, etc., are used in these machines, but these materials are not as effective as charcoal for generating carbon-monoxide and therefore cannot be recommended.

Application.—Carbon-monoxide may be generated and blown into burrows by means of an ordinary farm gas producer with a blower attached and mounted on wheels for mobility. Several machines have been manufactured especially for fumigating purposes and most have been found to be quite good. Some have hand operated blowers and others are driven by small engines.

CHLOROPICRIN.

This chemical was manufactured in wartime as a tear gas and is now used as a poison gas in enclosed places. It is $5\frac{1}{2}$ times heavier than air and is marketed in a liquid form. In both the liquid and gaseous states, it is non-inflammable and non-explosive.

Application.—The chemical is usually introduced into the warrens in a liquid form by means of old bagging, etc., saturated with the fumigant and pushed well down or by pressure oil cans, drenching guns and other implements which will squirt or inject it right down the openings. The advantage of using the saturated material method when applying the liquid is that no wastage occurs. Where the chemical is squirted or poured direct into a burrow there is every possibility of some loss resulting from soakage of the liquid into the soil, more particularly into dry sand.

Each opening requires about five cubic centimetres of chloropicrin (a teaspoon in a graduated measuring glass is approximately four cubic centimetres).

CYANIDE.

This is another chemical fumigant which is marketed in the form of calcium cyanide as dust (for preference) or flakes for rabbit fumigation purposes. A lighter-than-air gas known as hydrocyanic-acid gas is formed when these materials are brought into contact with air.

As it is lighter than the atmosphere, the gas must be forced down into the burrows as far as possible and the openings tightly closed to prevent leakages. In deep burrows, rabbits which shelter at the most remote parts may not be reached by the fumigant but many will be destroyed in the upper levels as they try to escape providing the entrances are securely sealed.

Application.—Various types of blowers and pumps are used to introduce the powdered or dust form. Care should be taken to ensure that the hoses attached to the fumigators are pushed as far down the burrows as possible.

OTHER FUMIGANTS.

Other fumigants, including smoke generators and chemicals such as sulphur dioxide and methyl bromide are used. Sulphur dioxide may be created by playing a blowlamp or burner on to a heap of sulphur at the mouth of a burrow and the rush of air will force the fumes inside. Occasionally arsenic is added to the sulphur. As a rule the gas does not penetrate very far and, although shallow burrows may be dealt with effectively, it is doubtful if success would be obtained with any which are deep.

Smoke may be introduced by special smoke producing chemicals which are ignited and placed inside the openings or by appliances which burn wood or leaves (usually green) and force the smoke into burrows. While rabbits in a shallow burrow may be roasted by the heat or even suffocated by the density of the smoke, insufficient poisonous gases would be created for fumigation purposes in a large warren.

POISONED BAITS.

Important Points to Observe.—When poisoned baits are being used, several important points must be observed.

Furrows and Trails.—These include the fact that a furrow or trail of broken earth is essential. The disturbed earth arouses the curiosity of the rabbits and assists in overcoming their timidity and in attracting them to the baits.

Free Feeding.—"Free feeding" or "prebaiting" with unpoisoned baits is often necessary to overcome this shyness and to ensure that all the rabbits will share in the poisoned baits when they are distributed. Baits used for poisoning must not differ greatly from those used for "free feeding" otherwise the rabbits may be suspicious. About one-third of the quantity of baits used in "free feeding" will be found sufficient when poisoning.

Sufficiency of Baits.—The strongest bucks will be the first on to the feeding grounds and until their appetites are satisfied the does and young rabbits will be forced to wait. Sufficient baits must therefore be used to ensure that the late-comers do not escape. Although unnecessary wastage is not recommended, it is preferable for too many baits to be used instead of too few.

Importance of Quality of Baits.—Rabbits are selective feeders—a fact which is evidenced by their well known preference for the best pastures. For this reason it is a waste of time and energy to use dirty and inferior utensils and ingredients for preparing baits. Everything, including containers, stirring implements, water and materials, should be cleaned and untainted. While a change of diet is a big lure, the baits being offered must be more attractive than other food available.

DIRECTIONS FOR USING DIFFERENT POISONS FOR DESTROYING RABBITS

PHOSPHORUS.

Phosphorus has been found to be one of the most effective poisons to use against rabbits. It may be mixed with bran and pollard and distributed, with the minimum of labour, by poison carts or "attachments" which are mechanical devices especially made for the purpose. The main time for using phosphorus preparations is in the summer and the advantages are that they are convenient to distribute, no "free feeding" (the distributing of unpoisoned baits to attract the rabbits) is required and the poisonous quality of the baits is oxidised by the air. Phosphorised baits, if mixed and properly distributed, will lose their poisonous properties.

There should be no fire hazard or danger to stock if the phosphorus preparations are mixed and used in accordance with the instructions.

It is a slow acting poison so that many carcasses will not be found near the baits.

PHOSPHORISED BRAN AND POLLARD.

A compound of phosphorus and molasses in two pound tins may be obtained from vermin boards. By an arrangement made by this Department with local wholesale and manufacturing chemists, this preparation is supplied to vermin boards at wholesale rates and is retailed to users at these rates, plus handling costs.

When using phosphorus, the following directions should be followed.

Opening Tins.—Thoroughly shake each tin before opening and take care to guard against any of the contents squirting out from where the opener is first inserted. A piece of cloth or paper wrapped around the first opening is a good precaution.

Mixing with Water.—Where a whole tin is used, empty all the contents into a large bucket (three to four gallons) containing 12 pints of good, clean water, and mix thoroughly. If the water is warmed, the mixing will be accelerated. Do not have the water too hot or the phosphorus may lose strength. Ensure that the bucket and water are quite clean and that all the contents of the tin are emptied. Dip the tin into the water and wash out the last remnants of the compound.

Adding Bran and Pollard.—Add sufficient bran and pollard (about a kerosene tin full), in the proportions of two parts of pollard to one of bran (measured in bulk), to form a fairly stiff mash. Mix thoroughly and, as variations will be found in the mixing qualities of different lots of pollard and bran, it may be necessary to experiment to obtain the best proportions.

Consistency of Mixture.—The ideal mixture for use in a poison cart is not too mashy to permit solid baits to be formed and dropped freely and not so stiff that the machine clogs or the baits are very hard. The baits should fall freely, be moist and sufficiently friable or loosely made to ensure that air may penetrate and oxidise the phosphorus.

Time of Day to Distribute Baits.—Distribute the baits fresh in the late afternoon (earlier in the day in dull cool weather).

Number of Baits Required.—If rabbits are in large numbers, drop an abundance of baits, two or three feet apart, along numerous trails. As already explained, it is preferable to use too many baits than too few. If the numbers of the rabbits are not so great, place the baits up to nine feet apart.

Furrows.—Form fresh furrows each time baits are laid and make frequent breaks in the furrow-line to discourage rabbits from running up and down and treading on the baits. If the rabbits are numerous the furrows or trails should be about a chain apart. The use of furrows is most important as freshly turned earth forms a great attraction to rabbits.

Length of Time Baits Remain Poisonous.—Eight to 10 days after baits have been laid, is usually considered a safe margin before turning stock into a paddock which has been poisoned. Many factors affect the rate at which the phosphorus is oxidised and it may be necessary to extend this period. A large bait remains poisonous longer than a small bait, a hard compact bait is poisonous for longer than an open friable bait. Moist cool weather prolongs the life of baits. In dry, summer weather, baits analysed 2½ days after laying contained no free phosphorus but different weather conditions and consistency of the mixture would alter this considerably. A simple test for the presence of free phosphorus is to break some of the baits in two and rub the broken ends together in the dark or to pound some baits in the dark with a hammer. Any phosphorus present will glow and, although the quantity may be so minute as to be insufficient to be poisonous, care would have to be taken with stock.

Necessity for Cleanliness.—Always use clean utensils, water and materials. Musty bran and pollard will not be eaten by rabbits.

Addition of Apples.—The addition of 3 lb. of minced apples and 1 lb. sugar to each tin of poison used, is an extra attraction where rabbits are fussy, particularly when green feed is available. An important point to remember is that, by mixing apples and sugar, the rate of oxidation of the phosphorus will be retarded and the baits will remain toxic for a longer period.

Time of the Year to use Baits.—Phosphorised bran and pollard baits are used mainly in the summer from the time the feed commences to dry off until winter rains commence. However, success is often obtained after the first novelty of green feed has passed.

Green Feed.—When green feed is about, make furrows in scrub or bare places a few chains away from the feed and in the direction from which the rabbits are travelling. Baits laid in the feed may not be taken.

Use of Small Quantities.—If the whole of a tin is not to be used, shake the contents very thoroughly to ensure that the poison is evenly distributed. Six parts of water are required to one part of the poison. Tightly cork the tin after use and place it where it cannot be knocked over.

Hand Laying.—If a poison cart or distributor is not employed, knead the mixture into a dough, flatten or roll out to about $\frac{1}{4}$ in. thick, and cut into $\frac{1}{4}$ in. cubes with a knife. Dust the cubes with dry pollard to assist handling. Make furrows with an ordinary plough or an implement such as a cultivator tyne attached to a bush sled. Drop the baits at the same intervals as already mentioned for a poison cart.

STRYCHNINE.

Strychnine is a deadly and quick acting poison which does not lose its toxic properties by exposure. Most of the rabbits killed will be found close to the baits. Apples or oats poisoned with strychnine may be used with great effect in winter as well as summer. "Free feeding" (i.e., the distribution of unpoisoned baits to attract the rabbits) is required and, although mechanical distributors have been devised, it is customary for baits to be laid by hand.

Strychnine is marketed in two forms—alkaloid, or pure strychnine, and soluble strychnine. Alkaloid strychnine, which is virtually insoluble in water, is obtainable as crystals or powder and may be white or coloured red to distinguish it from household preparations. Soluble strychnine is alkaloid strychnine to which an acid has been added to make it readily soluble in water and the forms usually manufactured are strychnine hydrochloride or strychnine sulphate, although other acids are sometimes used. It is always in a powdered form and also may be white or coloured red.

Great care should be exercised in obtaining the correct type of strychnine. If the directions specify alkaloid, the soluble form should not be used and vice versa. If soluble strychnine is required and only the alkaloid form is available the latter may be dissolved in acetic acid or vinegar. To each ounce of alkaloid strychnine a third of a pint of acetic acid or about two pints of vinegar is required.

ALKALOID OR SOLUBLE STRYCHNINE WITH OATS AND MOLASSES.

Oats, sweetened with molasses and poisoned with alkaloid or soluble strychnine, is recognised as an outstanding method of rabbit destruction in summer and winter and whether feed is scarce or plentiful.

"Free feeding" and well defined trails are necessary to make this method a success.

The following points should be observed.

Preparation of Baits for Free Feeding.—Boil the oats and molasses (treacle will do as a substitute) in water until the grain, which should be plump and of good quality, is soft. Two pounds of molasses are required to each 15 lb. of oats and sufficient water to keep the grain well covered should be used. After softening, remove the oats from the container and allow to drain on clean bagging. It is important that the ingredients, water, utensils and containers should all be perfectly clean.

Making Furrows.—Run the furrows—which are essential—as close as possible to infested spots and in such a way as to intercept the rabbits when travelling to feeding grounds. During the summer and when the country has been eaten out, the furrows will need to be some distance from burrows as the rabbits will be travelling a long way to feed. When kittens are about and feeding on green grass, make some furrows close to the warrens. Leave breaks in the furrows to stop rabbits from running up and down. Light plough furrows are the most effective. If the ground is too hard or stony, deep scratches or scrapes which actually break the ground will do.

Free Feeding.—Place a dessertspoonful of bait in the furrow about every 12 feet. To ensure that the rabbits have become accustomed to, and are eating the oats, it is usually necessary for this procedure to be followed for at least three nights. The poisoned baits should not be used until it is evident that the rabbits are freely taking the unpoisoned baits.

Time for Baiting.—Distribute the baits in the late afternoon (earlier in the day in dull, cool weather).

Preparation of Poisoned Baits.—Boil the oats and allow to drain in the manner already described. Place them in a large container and sprinkle with alkaloid or soluble strychnine, in the proportion of 1 oz. to each 24 lb. of boiled oats. Add the strychnine in small quantities at a time and stir the oats well after each application. Add 3 lb. of sugar to each oz. of strychnine used and stir the oats again thoroughly. The strychnine may be applied by a teaspoon or similar implement or by a tin with a perforated lid. If the strychnine is in crystal form, it requires powdering to a form which is free from grittiness by crushing or rolling (with a pestle and mortar or a bottle, etc.).

Allow the bait to stand for one hour before using.

Distributing Poisoned Bait.—Using the furrows which were made for “free-feeding,” place half a level teaspoonful of bait every six to eight feet. A third of the quantity of oats used in “free-feeding” will be sufficient for poisoning.

If large quantities of poisoned baits remain after completion of the poisoning, they should be picked up and destroyed or scattered by kicking and brushing with boughs, etc.

ALKALOID STRYCHNINE WITH GRAIN.

This is what is known as the “coated grain” method and may be employed with “free-feeding” (as described for oats) in destroying rabbits.

Ingredients.—To each 20 lb. of grain, 1 oz. of alkaloid strychnine, 1 oz. of baking soda, 1 teaspoonful of saccharine, $\frac{1}{2}$ cup of laundry starch, $\frac{1}{4}$ pint molasse or treacle, 1 tablespoon of glycerine, and 1 quart of water are required.

Preparation.—Mix the strychnine, baking soda and saccharine together, dry. Prepare the starch by mixing in a little cold water until smooth, pour into $\frac{3}{4}$ pint of boiling water, boil and stir until clear. Add the strychnine, soda and saccharine and then the molasses (or treacle) and glycerine stirring thoroughly.

Coating the Wheat.—Pour the paste over the wheat and stir until all the grains are coated. Spread the wheat on clean bagging, etc., to dry.

SOLUBLE STRYCHNINE WITH WHEAT.

Commonly known as the "soaked grain" method and may be used direct or in conjunction with "free-feeding" in the manner described for oats.

Ingredients.—To each 20 lb. of grain, 1 oz. of soluble strychnine, 6 lb. of brown sugar or golden syrup and $\frac{1}{2}$ gallon boiling water.

Preparation.—Dissolve the strychnine and sugar in the boiling water and pour the mixture over the grain. Add sufficient water just to cover the grain and bring to the boil. Allow to cool and soak for about eight hours stirring from time to time. Place the grain on bags, etc., to dry and then store in tins, etc., until required. The preparation may be allowed to simmer gently with frequent stirring in a vessel with a lid on. By this means the grain will be ready for drying in $2\frac{1}{2}$ to 3 hours.

ALKALOID STRYCHNINE AND APPLES.

When apples are available, they form an excellent bait for rabbits and should be used whenever possible. They may be used in both summer and winter.

A most important feature of using poisoned apples is "free-feeding" or the placing of unpoisoned baits to attract the rabbits.

The following points should be observed:—

Preparing Baits for Free-Feeding.—Cut apples into cubes about $\frac{1}{2}$ inch square and place from two to six feet apart—according to the number of rabbits—in furrows. It is preferable to use fruit which is sweet and sound, and the addition of sugar in quantities varying with the sweetness of the apples will assist. A pound of apples should make from 250 to 300 baits.

Making Furrows.—Run the furrows—which are essential—as close as possible to infested spots and in such a way as to intercept the rabbits when travelling to feeding grounds. During the summer and when the country has been eaten out, the furrows will need to be some distance from burrows as the rabbits will be travelling a long way to feed. When kittens are about and feeding on green grass, make some furrows close to the warrens. Leave breaks in the furrows to stop rabbits from running up and down. Light plough furrows are the most effective. If the ground is too hard or stony, deep scratches or scrapes which actually break the ground will do.

Free-Feeding.—Two to three free feeds before using poison are desirable. It sometimes happens that the rabbits will avoid the unpoisoned baits for the first or even the second night, but they should have lost their cautiousness by the third night. Take care that sufficient unpoisoned baits are used to ensure that all the rabbits have the opportunity of acquiring the taste. For this reason there should always be a few baits left the following morning when "free-feeding."

Time for Baiting.—Distribute the baits in the late afternoon (earlier in the day if the weather is dull and cool).

Cutting and Sweetening the Poisoned Baits.—Cut the apples for poisoning to the same size and, if sour, sprinkle 2 lb. of sugar on to each 12 lb. of cut baits. Mix the baits and then spread out on clean bags to drain. This draining is important as otherwise the strychnine will be washed away.

Preparing the Strychnine.—If the strychnine is not powdered, grind it finely with a pestle and mortar or roll it with a bottle on strong brown paper or similar substance. Place it in a pepper shaker or a tin with a perforated lid. To assist the strychnine to run freely, the addition of about one-third its bulk of cornflour or plain flour is recommended.

Adding the Strychnine.—Place 2 to 3 lb. of baits in a mixing bowl, sprinkle with a little powdered strychnine alkaloid and mix thoroughly. Add more baits, sprinkle and mix until the bowl is full or the required quantity is reached. Sprinkle a little icing sugar over the baits after the strychnine has been added, particularly if the apples are sour. The baits are then ready for distributing. One ounce of strychnine is sufficient for 12 to 16 lb. of baits.

Distributing Poisoned Baits.—Distribute the poisoned baits in the same furrows used for "free-feeding." About one-third of the quantity used for "free-feeding" will be required for poisoning, i.e., for each 3 lb. of apples used in "free-feeding," use 1 lb. for poisoning.

ALKALOID STRYCHNINE AND PEARS OR QUINCES.

Follow the same method as for poisoning apples. It will be found, however, that apples have a greater attraction for rabbits.

ALKALOID STRYCHNINE AND CARROTS.

Carrots, when fresh and crisp, form an effective bait for rabbits in the winter. If soft or dry the carrots will not be attractive. As in baiting with apples, "free-feeding" is essential.

As strychnine will not adhere to raw carrots, the addition of sugar as a holding agent is essential and the method of preparation is as follows:—

Preparing Baits for Free-Feeding.—Cut the carrots into cubes $\frac{1}{2}$ in. square and add 2 lb. of icing sugar to each 15 lb. of baits. Mix thoroughly and leave to drain off all surplus liquid.

Free Feeding.—Follow the same procedure outlined for apples.

Preparing Poisoned Baits.—Cut the carrots into the same sized cubes and add 2 lb. of icing sugar to each 12 lb. of baits, which should be mixed up and allowed to drain. Sprinkle 1 oz. of powdered alkaloid strychnine over each 12 lb. of bait. Add the strychnine slowly and stir the baits continuously during the application. Sprinkle on another 1 lb. of icing sugar and leave the baits for one hour before distributing.

Distributing Poisoned Baits.—Normally one cube every nine feet will be found sufficient, but if rabbits are numerous the number of baits used should be increased and the distance apart decreased accordingly. For poisoning, use about one-third of the quantity of baits required for "free feeding."

SOLUBLE STRYCHNINE AND CARROTS.

Follow the same procedure for "free feeding" and distribution, etc., used in connection with alkaloid strychnine. The poisoning of the baits is different however.

Preparing Poisoned Baits.—Dissolve 1 oz. of soluble strychnine, 8 oz. icing sugar and half tablespoonful of glycerine in a gallon of water which should be heated if possible. Soak the baits in this mixture for at least 10 minutes, then take out and allow to drain.

SOLUBLE STRYCHNINE AND JAM.

Jam poisoned by soluble strychnine is obtainable as a proprietary preparation, but the following directions are given for the information of anyone who wishes to prepare some.

Ingredients.—To each oz. of soluble strychnine, 16 lb of quince or raspberry jam. If home-made jam is being especially prepared for the purpose, only half the usual quantity of sugar is required and a little boric acid should be added as a preservative.

Preparation.—Sprinkle the soluble strychnine into the jam while stirring the latter very thoroughly to ensure that the strychnine is spread right throughout the mixture. The jam may be used by itself or sufficient pollard may be added to form a stiff dough. Experimentation with small quantities will show which the rabbits prefer.

Distribution.—Make shallow furrows with a plough or scrape the ground with a shovel, etc., ensuring that the earth is actually broken. Place lumps of the mixture the size of small marbles on pieces of wood, bark, etc., about every 9 to 12 feet (according to the number of rabbits) in the furrows.

ALKALOID STRYCHNINE AND SWEDES OR PIE MELONS.

Baits made of swedes or pie melons, while not as attractive, may be used as alternatives to carrots. The method of using them is similar to the procedure outlined for carrots.

ARSENIC.

Arsenic imparts a sour, metallic taste to baits which apparently are not as palatable to rabbits as those in which other poisons are used.

Pure arsenic is not readily dissolved in water and 8 oz. of washing soda should be added to each pound to make it soluble.

Arsenite of soda, which is arsenic to which the soda has already been added, may be substituted for pure arsenic. Where normally 1 lb. of pure arsenic is used, 1½ lb. of arsenite of soda are required. Arsenite of soda is regarded as being more palatable than pure arsenic.

Arsenical poisons are slow-acting and are not destroyed by exposure. After having had contact with this poison, it is advisable for the user to wash his hands in water to which a little phenyle has been added.

ARSENIC (OR ARSENITE OF SODA) WITH GRAIN.

Ingredients.—To each lb. of arsenic, about 21 lb. of grain (approximately three-quarters of a kerosene tin), 8 oz. washing soda, 1½ gallons of boiling water, 4 lb. of sugar, 1½ lb. of arsenite of soda may be substituted for the pure arsenic and washing soda.

Method of Preparing.—Dissolve the arsenic, washing soda (or arsenite of soda) and sugar in the boiling water. Pour the mixture over the grain—adding more water if necessary—until the grain is just covered. Bring the preparation to the boil and then allow to cool and soak for eight hours. Keep well stirred. Place the poisoned grain on bags or other materials to dry and then store in tins, etc., until required.

If the preparation is placed in a vessel with a lid on and allowed to simmer gently with frequent stirring, it will be ready for drying in 2 to 2½ hours.

Method of Distributing.—A light plough furrow or a trail made by a spade or hoe, etc., is necessary. The trails should be made between where the rabbits are harbouring and where they are feeding. The trail needs breaking frequently to prevent rabbits from running up and down and scattering the baits. The grain should be placed in the trail, about a tablespoonful at a time, 9 to 12 feet apart or closer when the rabbits are numerous.

Baits not Eaten.—Any baits remaining should be picked up and buried or scattered widely by kicking or sweeping before any stock or domestic animals are allowed in the vicinity.

ARSENIC WITH APPLES, CARROTS, ETC.

Ingredients.—To each 1 lb. of arsenic, 12 to 16 lb. of apples or carrots are required. Two lb. of sugar will be required for this quantity of apples and 4 lb. of sugar for the carrots.

Method of Preparing.—If apples are used, they should be cut into half-inch cubes and the arsenic sprinkled on while the baits are being stirred. The baits should then be sweetened with sugar.

Carrots should be cut into half-inch cubes and allowed to stand until all excess moisture has drained away. They should then be covered thickly with sugar and well mixed. The arsenic should then be sprinkled on while the baits are being stirred.

Method of Distribution.—The procedure described for distributing apples poisoned with strychnine should be used.

ARSENIC WITH POLLARD.

Ingredients.—To each 2 lb. of arsenic, 10 lb. pollard, 2 lb. bran, 2 pints of treacle or honey (or 5 lb. of sugar) and 1 gallon of hot water.

Method of Preparation.—Dissolve the treacle, honey or sugar in the hot water. Mix the arsenic, pollard and bran together and gradually add the water while the mixture is being stirred. Continue stirring until the preparation is well mixed. If the baits are to be laid by hand, a dough-like consistency is required, but if a machine is to be used, it may be necessary to increase the proportion of bran. Considerable variations in quality are found in different lots of bran and pollard, so that it is often necessary to experiment with mixtures to ensure that the right consistency is obtained for the machine being used.

Method of Distribution.—Distribute the baits by the methods already described for phosphorised bran and pollard. It should be remembered, however, that baits poisoned with arsenic do not lose

their poisonous properties with exposure. They are always poisonous and any remaining should be picked up before stock are allowed access to the poisoned paddocks.

ARSENITE OF SODA WITH POLLARD.

Ingredients.—To each 2 lb. of arsenite of soda, 20 lb. of pollard, 4 lb. of bran, 4 lb. of molasses or treacle and $1\frac{1}{2}$ gallons of water.

Method of Preparation.—Dissolve the arsenite of soda and molasses or treacle in boiling water and add more water if necessary to bring the quantity to $1\frac{1}{2}$ gallons. When the ingredients are completely dissolved, gradually stir the bran and pollard into the mixture until a fairly stiff mash has been formed. As mentioned in the preceding recipe, it will be necessary to vary the consistency of the mixture according to the means to be adopted for laying the baits.

POISONED WATER

In the dry areas, particularly at the times of the year when water is scarce, total extermination of all the rabbits around watering places is possible.

As in other poisoning methods, "free feeding," or the use of unpoisoned water until the natural timidity of the rabbits is overcome, is necessary.

Various means of providing the water may be used, including the raising of stock troughs to a height which prevents rabbits from reaching them. The poison containers may then be placed on the ground and covered in such a manner that only rabbits are able to reach them. Ordinary drinking troughs, which the rabbits are able to reach, may be used if the stock are kept out of the paddock. Dams which the rabbits are using may be fenced off and the containers placed outside.

The containers may consist of shallow troughs or dishes or even old meat or fruit tins which are wide enough for a rabbit's head to enter.

To prevent loss of bird life, it is recommended that the poison should be placed out after dark and removed before daylight.

POTASSIUM OR SODIUM CYANIDE WITH WATER.

Possibly because of its quick action and the fact that its toxic qualities are lost within a few days, cyanide is a popular poison for use in water. The potassium and sodium forms are equally effective.

Mixing the Cyanide.—For each 100 gallons of water, 1 lb. of cyanide is required or 6 gallons of water for an ounce of cyanide. The cyanide should be dissolved in a small quantity of cold water, at about $\frac{1}{2}$ pint to each ounce of cyanide, and then added to the bulk of water to be poisoned. Hot water should not be used.

Containers.—Containers should not be made of zinc or tin; wood, enamel and black iron or steel are preferable. Rusted tins are better than any which are new and bright. Cyanide, if brought into contact with zinc or tin, not only destroys these metals, but, in doing so, quickly loses its potency.

Period Remaining Poisonous.—The length of time cyanided water remains poisonous depends on the purity of the water. If the acid content of the water is high, all trace of the poison may be lost in as short a period as 24 hours. Three days is the usual period and sometimes even longer.

ARSENIC (OR ARSENITE OF SODA) WITH WATER.

Arsenic has been found to be a good poison for use with water. It may be used for destroying rabbits and is especially effective against kangaroos. It should be remembered that, unlike cyanide, arsenic does not lose its strength with exposure. The difference between the methods of using arsenic and arsenite of soda have been explained already under the heading of "Arsenic." Briefly, arsenic is difficult to dissolve and washing soda must be added; arsenite of soda is arsenic combined with the soda and is soluble. As a result of this combination, three parts of arsenite of soda must be used where two parts of arsenic would suffice.

Ingredients.—To each 1 lb. of arsenic, $\frac{1}{2}$ lb. of washing soda, 1 lb. sugar, 1 gallon of boiling water. ($1\frac{1}{2}$ lb. of arsenite of soda may be substituted for the arsenic and washing soda.) This will be sufficient to poison 30 gallons of water. For smaller quantities use 1 oz. of arsenic, $\frac{1}{2}$ oz. of washing soda (or $1\frac{1}{2}$ oz. arsenite of soda), 1 oz. of sugar, to each 2 gallons of water.

Method of Preparation.—Add the arsenic and washing soda (or arsenite of soda) to the water and boil until dissolved, keeping the mixture well stirred, as it will boil over readily. Add the sugar and stir well until dissolved.

SOLUBLE STRYCHNINE WITH WATER.

Strychnine may be used in water with success, but owing to the intense bitterness of this poison, sugar or saccharine must be added. If soluble strychnine is not available, one ounce of alkaloid strychnine may be dissolved in one-third of a pint of acetic acid or two pints of vinegar.

Ingredients.—To each oz. of soluble strychnine, 2 lb. of sugar or one-eighth oz. of saccharine, and 12 gallons of water.

Method of Preparation.—Dissolve the soluble strychnine and sugar (or saccharine) in 2 gallons of hot water and add to the other 10 gallons.

POISONOUS OR REPELLENT WASHES FOR FRUIT TREES

Serious damage is often done to fruit trees—particularly young trees—by rabbits. The best protection is by netting either in the form of a fence around the orchard or in rolls round individual trees. Sacking, and other materials, may also be bound around the trunks. Success has often been claimed for the following methods—the first is a poison wash to destroy any rabbits nibbling at the trees and the second is a repellant to keep the rabbits away.

POISONED WASH.

Ingredients.—To each 1 oz. of soluble strychnine, $\frac{1}{2}$ lb. laundry starch, 6 oz. of glycerine and 3 quarts of boiling water.

Preparation.—The starch should be dissolved in one pint of cold water and the strychnine dissolved in the boiling water. The starch should be poured into the boiling water and the mixture boiled until it is clear, when the glycerine should be added.

Application.—The mixture when cold should be applied to the trunks for about 18 inches with a paint brush.

REPELLENT.

Ingredients.—1 gallon of raw linseed oil and 12 oz. of sulphur powder.

Preparation.—The oil should be heated (out of doors) in a 5-gallon drum to 470° F. (243° C.), when it will give off a bluish smoke. A thermometer should be used. The drum should then be removed from the fire and the sulphur added a teaspoonful at a time while the oil is well stirred.

Application.—The mixture should be allowed to cool and daubed on the trunks. In some cases, it has been found to burn very tender trees. Sticks or lathes coated with the preparation may be placed closely around each tree instead of painting the trunks.

FENCING OF WATER SUPPLIES TO FORM TRAPS

In dry areas where rabbits must go to certain places, such as dams, waterholes, etc., for water, they may be trapped quite simply in an enclosure which will permit the rabbits to enter but will prevent them from leaving.

Method to be Adopted.—The watering place should be surrounded by a rabbit-proof netting enclosure with small openings on the inside of which funnels of wire netting are attached. The funnels should be about 18 inches long, six inches wide at one end and three and half inches at the other. The smaller end should be left as jagged as possible. Holes should be made in the fence and the wider ends of the cones secured so that the cones lie along the ground facing inwards. The bottoms of the holes in the fence which lead into the funnels should be slightly below ground level so that no obstacle is placed in the way of the rabbits. The rabbits will enter by the funnels, but as they move around the fence searching for a means of escape they will pass by the funnels.

Catching the Rabbits.—All rabbits caught in these traps may be destroyed by catching and killing them. Much labour may be saved by placing small enclosures at one or more corners of the fencing with additional funnels leading inwards. Most of the rabbits will eventually find their way into these confined spaces and may be destroyed more readily.

Fencing of Pastures to Form Traps.—The method described for fencing water supplies may be used for enclosing particularly attractive sections of pasture. Special grasses may be grown in the area concerned. It is necessary for a section of the enclosure to be left down or gates to be left open until the rabbits are feeding on the pasture. Netting funnels are inserted as already described and, particularly if the area is large, corner traps are advisable.

EMUS

Owing to their extreme mobility, emus are very difficult to trap or poison, although success may be obtained in certain circumstances. Shooting is the method generally favoured.

SHOOTING.

This is the method generally favoured and shotguns, used from a motor vehicle, are the weapons with which most success is obtained. Isolated hunting parties may account for many emus but, for best results, large scale, district wide operations should be organised.

TRAPPING.

Emus may be trapped by being driven into a wing built out from a fence. Once cornered, they may be enclosed with a temporary fence or forced into a pit and destroyed. By weight of numbers they will smash or seriously damage an ordinary fence and strong reinforcement is required in a trap of this nature. These traps require someone in attendance to drive the birds in and to destroy them.

POISONING.

Owing to their extreme mobility, emus are difficult to poison, but if a place where they are regularly watering or feeding is located, success may be obtained. It has been found that the placing of a brightly coloured or shiny object on a fence or tree will sometimes attract the attention of emus to water or baits nearby.

WATER.

During the summer months, in places where surface water is not available and stock waters are well fenced, many emus have been destroyed with poisoned water. Place a number of containers filled with fresh clean water in localities where the emus are likely to congregate. As emus prefer to sit or squat down to drink, the containers should be sunk into the ground. When it is observed that the birds are using the water, poison should be added. Any of the recipes mentioned for poisoning water for rabbit destruction may be used.

BAITS.

If it is noticed that the emus are feeding on some particular food, the material concerned should be poisoned, using any of the recipes mentioned for rabbit destruction. Unpoisoned wheat may be placed in heaps and if eaten by the emus, it may be replaced by poisoned wheat. Wheat ears may be poisoned by soaking in prepared phosphorus rabbit poison or coated with the strychnine mixture described for coated grain baits.

KANGAROOS

Wholesale destruction of kangaroos, euros and wallabies, etc., is usually carried out by means of poisoned water or poisoned baits.

POISONED WATER.

When conditions are dry and kangaroos are forced to water in certain places, such as troughs, water holes, etc., they may be easily poisoned using the same general methods as advocated for poisoning rabbits on previous pages.

Arsenic and arsenite of soda have been found the most satisfactory poisons and may be used as described, although the addition of sugar has not been found essential.

Cyanide does not seem to be as effective but may be used if quick deaths are required. For this reason, cyanide is often used when the kangaroos are to be skinned.

POISONED BAITS.

Any food which the kangaroos will eat, such as grain or bran and pollard, may be used for baiting purposes. It may be necessary to experiment by "free feeding" until the most attractive material is discovered.

The recipes already given for rabbit destruction will be found satisfactory, although, if phosphorised bran and pollard are used, the mixture should be somewhat drier and in a friable condition. It should be laid in rows about 2 chains in length with breaks of 3 to 4 yards between each row.

Oats poisoned in the manner described for poisoning grain may be found successful. The oats should be laid in rows as described in the preceding paragraph.

The use of trails or furrows along which the baiting materials are placed will be found to assist in attracting the kangaroos.

PARROTS

Parrots may be destroyed by trapping or poisoning with baits or water. Whatever method is used, it is necessary to discover first of all where they are feeding or drinking and on what they are feeding or will feed. In many instances it is necessary to try out various foods until one which the birds will take readily is found.

TRAPPING.

Trapping may be carried out by using a wire covered box-like framework propped up on one side by a stick. The stick may be pulled away by a piece of string attached to it and held by someone concealed some distance away. Grain or other bait is sprinkled on the ground in trails leading under the framework. This method may be regarded as crude, but it is effective.

GRAIN POISONED WITH SOLUBLE STRYCHNINE.

Poisoned grain prepared in the manner described for rabbit destruction may be used with success. Free feeding is usually necessary. As parrots crack the grain to eat the kernels, the soaked grain method must be employed. If strychnine is coated on, it will be discarded with the husks.

APPLES POISONED WITH SOLUBLE STRYCHNINE.

With a packing needle, thread string through a number of firm juicy apples of a variety favoured by the parrots. The string should run from stem to calyx and a few inches should be left at each end. Take a plug a little less than half an inch across out of the side of each apple by inserting the blade of a penknife almost to the core and giving it a turn. Into the hole insert sufficient soluble strychnine to heap on the point of the penknife for about quarter of an inch, and re-insert the plug. If the fruit is large another hole should be made. Allow the apples to stand for 12 hours before use, by which time the strychnine will have permeated the fruit.

Distribution.—Tie several apples on to a bough which may be from a gum or other tree and attach the bough to a long pole. Place the pole in an apple tree, from which all the fruit has been stripped, so that the bough above is above the foliage of the tree. The parrots will normally alight on the highest part of the tree and will find the apples.

Prepare several trees in parts of the orchard for which the parrots appear to have a preference. Move the boughs as desired and replace the apples which are eaten until the parrots have been destroyed.

Rapidity of Effect.—The poison should commence to act within 10 minutes or more. Some birds will drop where they have taken the poison but others will be frightened and will fly up to considerable distances before dying.

POISONED WATER.

Water poisoned by any of the methods described for poisoning rabbits will be found very effective. Care should be taken to protect other useful birds.

WEDGE-TAILED EAGLES

Wedge-tailed eagles may be destroyed by trapping or poisoning.

TRAPPING.

Set two or three rabbit traps (dog traps may be substituted) about 18 inches or even more away from a lure of meat, etc., and slightly below ground level with a light covering of soil. If the traps are set closer the birds may reach over them without being caught.

The traps must not be anchored to the ground although they may be secured to light logs and rocks, etc., just sufficiently heavy to prevent a trapped eagle from rising from the ground. If the traps are staked, an eagle may easily escape by breaking off its leg or claw. With loose traps the birds will not travel very far and will be readily caught by inspecting the location soon after sunrise and just before sunset.

The lure may consist of meat of any sort and including sheep's heads, birds or any part of a carcase, but it must be fresh. Whatever is used must be firmly staked or spiked to the ground otherwise it may be carried away by a swooping eagle.

The eagles should be guided on to the traps by the careful placing of light bushes or sticks around other sides of the lure. The bushes, etc., should not be strong enough for an eagle to alight on them.

Several of these lures may be used with the corresponding traps, depending on the number of eagles to be destroyed.

POISONING.

Remove the skin from the head, neck and back, etc., of freshly killed animals such as kangaroos, etc. Cut long slits or slashes in the bared portions, placing the knife deeply and at an angle to make flaps. Insert finely powdered alkaloid strychnine in the cuts and close the openings. The carcasses should be placed in the open and staked or otherwise secured.

RATS

Rats are real pests in homes and buildings and the damage they do to food and property is enormous. They also befoul and contaminate foodstuffs and their presence always brings a risk of serious diseases to man.

EXCLUSION.

The real solution to the rat (and also mice) problem in buildings is exclusion and this means essentially two things—leaving no opening more than $\frac{3}{8}$ in. in width and protecting all food supplies from these animals.

POISONED BAITS.

Where rats are established, however, the use of poisoned baits has been found to be the most successful method of dealing with them. The principal poisons used locally are phosphorus, red squills powder, thallium sulphate and Antu, although arsenic, barium carbonate and other poisons are sometimes employed. Zinc phosphite and "1080" are recommended overseas, but the last is too dangerous for public use. The four mentioned as the main poisons are obtainable in proprietary preparations which are reported to be satisfactory.

Ready mixed phosphorus poison has proved to be very effective, but every care must be taken to ensure that the preparation is thoroughly mixed before being used in baits. Red squill powder is generally regarded as being poisonous only to rats, but it is always a safe measure to ensure that children and domestic animals do not have access to any poison or baits. Antu is particularly useful against brown rats (*Rattus norvegicus*) but is considered less toxic against other rats, mice or animals. Thallium sulphate is a particularly deadly poison and has been found to give very good results. The main point is to ensure that any preparation purchased contains a recognised poison.

The instructions given with the poison preparations are usually fairly reliable, but the following general information should be of assistance.

Baits may be made of pollard mixed with the poison and cut into half-inch cubes, but excellent results have been obtained by the use of bread slices or sandwiches cut into similar sized or slightly larger squares.

Possibly the most important feature of poisoning is preliminary "free feeding." This consists of placing ample supplies of unpoisoned baits about for two or three nights before poisoning. By this means, it is possible to ensure that the material to be baited will be eaten and also that enough baits are being used. Sufficient material should be used to allow a few baits to be left uneaten, thus showing that none of the rats have gone hungry. Naturally it is necessary for some food to be used which is more attractive to the rats than any other foodstuffs available. The addition of dripping, fish paste, peanut paste, etc., has been found useful while biscuits, stale cake and other materials may be used.

The baits should be spread liberally—preferably just prior to nightfall—near holes or where the rodents have been feeding. If there is a danger of children or domestic animals having access to the baits, any left over should be picked up as early as possible the following morning.

TRAPPING.

While poisoning is the most successful method of destroying rats, there is a disadvantage in buildings, that carcases very often lodge between walls and under floors where they putrefy. For this reason many people prefer to use traps and the common spring or "break-back" type is quite good. The traps should be placed along any routes or runs which the rats are known to follow; for instance, alongside a wall behind some object, such as a box. Some traps have plates which release the springs when the rats step on to them and a sprinkling of pollard, flour, sawdust, etc., will help to conceal where they are placed. Where traps are baited, meat, fish, vegetables and fruit will be found attractive and, although these foods may be cooked, the rats seem to prefer them raw. Raw meat or bacon rind attached to the trap and then singed with a match is a good bait. It may be necessary to try various foods as baits on unset traps to determine which the rats prefer. When traps are used, it should be ensured that the trigger releases easily as, in many cases, considerable pressure is required before the trap will spring. This means that the baits could be removed without the rats being caught. Tying the baits on to the triggers may help also.

As in baiting, it is important to remember that a sufficient number of traps must be used to ensure that the rats are accounted for as quickly as possible. If insufficient traps are used, there is a danger of the rats being frightened away temporarily. Usually they will return within a short time and continue to do damage.

FUMIGATION.

Fumigation may also be used where the nests are known. Any of the recognised fumigants such as cyanide, carbon-bi-sulphide, carbon-monoxide and chloropicrin are effective but every care should be taken if using in or near a building.

MICE

Mice are very troublesome in farm buildings and sometimes among crops. Stored fodder whether in stacks, bins or bags is often seriously damaged.

EXCLUSION.

The most effective manner of preventing damage is by excluding the pests or protecting foodstuffs.

Hay may be stacked on a raised platform, the posts being capped with galvanised iron squares to prevent mice from climbing up them. Care must be taken to ensure that weeds are not allowed to grow up the posts and that materials are not permitted to hang down from the platform. A temporary mouse-proof fence made of flat iron may be constructed around a hay stack. The iron should be about three feet above ground and about six inches under. The top edge should be turned over at rightangles for about six inches, facing outwards from the stack. The corners and the lapping must not be open. For added strength the sheets may be fixed to uprights erected on the inside of the fence. Forty-four gallon drums make good stands on which bags of grain may be stored.

TRAPPING.

Trapping is a good way of destroying mice, particularly in houses or buildings. Various traps are obtainable but the "break back" and similar types are quite good. The traps should be placed along walls, with the trigger end towards the walls, or behind boxes, etc. If there is a heavy infestation it is advisable to use as many traps as possible.

Baits should consist of slices of fruit or vegetables, pumpkin seeds and bread, biscuits, raw or cooked bacon or meats. If cheese or raw bacon and meat is used, it is a good idea to attach the bait to the trap and then singe it with a match.

POISONING.

For wholesale destruction and for destroying mice in the field, poisoning is the most effective method to use.

All of the poisons and baits recommended for rat destruction will be found satisfactory, while "free-feeding" or pre-baiting is essential.

Wheat poisoned with strychnine is widely used. The recipes described for poisoning wheat for rabbit destruction are applicable, or wheat, already poisoned, may be purchased.

ANTIDOTES FOR POISONS

FOR HUMAN BEINGS.

The following information has been obtained from the Department of Public Health.

PHOSPHORUS.

Soon after swallowing an appreciable quantity of phosphorus, the following symptoms develop:—

A garlic-like taste in the mouth.

A burning sensation in the throat.

Vomiting of greenish black material which smells of garlic and may be luminous in the dark.

Diarrhoea may ensue.

The signs of shock usually develop, i.e., weak, irregular pulse, cold clammy skin, and sub-normal temperature.

In severe cases these symptoms progress to coma, convulsions, and death; but in most cases the symptoms subside. Two or three days later, however, fresh symptoms appear—there is a recurrence of adominal pain and vomiting, and jaundice develops.

Treatment.—5 grains of copper sulphate (blue-stone) in a tumblerful of water—repeated in 15 minutes. If a stomach tube is at hand and someone capable of introducing it is available, the stomach should be washed out with a dilute solution of copper sulphate (10 grains to the gallon of water) or of potassium permanganate (1 oz. to the gallon of water).

N.B.—Oils and fats should not be given as phosphorus is soluble in these substances and is, therefore, likely to be absorbed more readily.

ARSENIC.

If a quantity of arsenic is swallowed, evidence of acute irritation of the stomach and intestines follow within a few hours. The symptoms include:—

Nausea, faintness, a burning sensation in the “pit of the stomach,” retching and persistent vomiting, followed by diarrhoea.

Cramps in the lower limbs are common, and collapse may ensue.

The swallowing of relatively small doses over a prolonged period result in symptoms of so-called “chronic arsenical poisoning.” Loss of weight, falling out of the hair, pigmentation of the skin, and often persistent symptoms of a common cold, loss of appetite, diarrhoea, intermittent vomiting, numbness in the hands and feet, unsteady gait—are all seen.

Treatment.—Encourage vomiting by tickling the back of the throat with the fingers or making the patient swallow two tablespoonfuls of salt in a tumber of water every five minutes. The specific antidote is made as follows:—Mix half an ounce of liquor ferri perchloridi with 4 ounces of water; add to it 4 ounces of a saturated solution of washing soda. Strain off the resulting precipitate and give it mixed with water.

STRYCHNINE.

Within a few minutes of swallowing a poisonous dose of strychnine, the following symptoms develop:—

Intensely bitter taste in the mouth.

Sense of suffocation.

Twitching of muscles of neck, body and limbs—followed by convulsions with arching of the back, blueness of the face and clenching of the jaw.

A series of such convulsions can be provoked by the slightest stimulus such as a draught of air or a sudden noise.

Treatment.—Induce vomiting immediately either by irritating the back of the throat with the fingers or by means of one of the usual emetics, e.g., two tablespoons of salt in a tumbler of water, a tablespoonful of mustard in a tumbler of water, or about 5 grains of copper sulphate (bluestone) in half a tumbler of water. Special antidotes said to be of use are tannin (30 grains in 2 oz. of water) and tincture of iodine (half a teaspoonful in half a tumbler of water)—followed by an emetic.

FOR STOCK.

The Stock Branch of the Department of Agriculture recommend the following:—

The antidotes for phosphorus poisoning are old or French turpentine and sulphate of copper (bluestone). The doses of the old or French turpentine are:—

1 ounce for horses and cattle.

2 drams for sheep and pigs.

The doses of sulphate of copper (bluestone) are:—

1½ drams for horses.

2 drams for cattle.

25 grains for sheep.

8 grains for pigs.

These may be mixed and given as a drench in a little water.

As an antidote for strychnine poisoning, chloral may be given, the doses being:—

1 ounce for horses.

1½ ounces for cattle.

1 dram for sheep and pigs.

This can be given mixed with a little milk.

TABLE OF EQUIVALENT QUANTITIES

3 grains = cover sixpenny piece.

15 grains = heaped sixpenny piece.

6 grains = cover shilling piece.

21 grains = heaped shilling piece.

1 drachm = 1 teaspoonful level.

¼ ounce = 1 dessertspoonful level.

½ ounce = 1 tablespoonful level.

Worms in Pigs

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(As revised from the article which appeared in Vol. XX, No. 1, March, 1943, pages 59-62.)

The only internal parasite of economic importance occurring in pigs in Western Australia is the large roundworm—*Ascaris lumbricoides*. This parasite is widely distributed and occurs in most areas where pig raising is practised. Heavy infestations may be responsible for considerable economic loss. Young pigs are particularly susceptible and in consequence their development is severely retarded. Infested animals become stunted in growth and unthrifty in appearance. Mortality may occasionally occur amongst very young pigs.

These large worms occur in the small intestine. They are creamy white in colour, cylindrical in form and taper to a point at both ends. The average length is between six and 10 inches. Some may attain a length of 15 inches.

LIFE HISTORY

The female worm is a prolific egg layer and may produce as many as 200,000 eggs daily. These are passed out with the droppings and contaminate the soil. In from 10 to 40 days or longer after reaching the exterior, the eggs develop to the infective stage when they are found to contain a larval parasite coiled up within the shell. These eggs are extremely resistant and may remain viable for several years. When, however, they are exposed to direct sunlight under hot, dry conditions they are unlikely to survive for more than a few weeks.

Infective eggs are swallowed with the food or water and in the case of young pigs may be picked up from the teats of the sow during feeding. Upon reaching the small intestine of the pig the eggs hatch, and the larvae are set free. They burrow into the wall of the intestine and reach the blood vessels by which means they are carried to the liver and then via the heart to the lungs. Here they pass from the blood vessels to the alveoli or air sacs of the lung, and after undergoing further growth and development migrate up the trachea (windpipe), are swallowed, and pass down to the small intestine. Here they remain and grow to maturity.

SYMPTOMS

The effects of the parasite are almost entirely confined to pigs under four months old. Although older animals may harbour the worms in quite considerable numbers they rarely suffer any ill effects.



The large roundworm of the pig, *Ascaris lumbricoides*.

In the case of young pigs growth is seriously impaired, and the animals become unprofitable. They remain stunted and unthrifty; the coat is rough and the animal has a pot-bellied appearance.

During their migration through the liver and lungs the larval worms inflict considerable injury which may prove fatal to young pigs during the first weeks of life. Pneumonia may develop as a sequel to the lung damage. In young pigs the invasion of the lungs by large numbers of larvae may set up symptoms of laboured and forced respiration, this condition being commonly known as "thumps." The development of pneumonia is denoted by the presence of a short hard cough which is particularly noticed after exertion. It must, however, be pointed out that the symptom of coughing so prevalent amongst young pigs is frequently due to infectious pneumonia and is not in any way related to the invasion of the lungs by ascarid larvae.



Drenching a young pig.

DIAGNOSIS

When the presence of roundworms is suspected the diagnosis may be confirmed by the slaughter and post mortem examination of an animal showing typical symptoms. The worms will be found in the small intestine or "runners" which extends from the stomach to the caecum or blind gut. This portion of the intestine should be freed from its attachments and opened with scissors. The parasites, when present, will not be overlooked on account of their large

size. Occasionally worms which have wandered from their natural habitat in the small intestine may be found in the stomach or in the bile ducts of the liver.



This is a portion of the small intestine of a pig tightly packed with large roundworms (*Ascaris lumbricoides*). Treatment with sodium fluoride which have removed most, if not all, of the parasites.

Both the liver and lungs may show evidence of the injury inflicted by the larval worms during their migration. The surface of the liver may show the presence of whitish areas about $\frac{1}{4}$ in. diameter. These are popularly known as milk spots. The lungs may show more or less extensive solid pneumonic areas which contrast sharply with the spongy normal lung tissue which surrounds them.

When a post mortem examination cannot be performed a diagnosis can usually be established by the examination of a sample of the droppings in the laboratory for the presence of worm eggs.

TREATMENT

Sodium Fluoride.

For the treatment of affected pigs best results will be obtained from the administration of sodium fluoride. This is a powder which should be given in the feed and the following dosage should be employed:—

Dose Rates

Live Weight of Pigs. lb.	Number of Pigs to 1 ounce of Sodium Fluoride.
20	14
21-40	7
41-60	4
61-80	3
81-100	2 $\frac{1}{2}$
101-150	2
151-200	1 $\frac{1}{2}$
over 200	$\frac{5}{8}$

Prior to treatment the pigs should be graded into small groups (up to 10 animals) of even size, and the amount of sodium fluoride to be administered in their feed computed on a weight basis by reference to the above table.

This should be accurately weighed and thoroughly mixed in an amount of food which will be consumed during the course of the day.

An allowance of one pound of the treated food mixture per 25 pounds live weight will be found adequate.

On this basis, seven weaners averaging 35 pounds would receive one ounce of sodium fluoride in about 10 pounds of food material. This amount will usually be consumed during the day, but should any remain uneaten it should be mixed with the evening feed. The drug will be taken readily in a mixture of crushed wheat and meat meal, which should always be fed dry, but any other meal mixture will be found equally satisfactory. It should never be given with wet mash or as a drench, as toxic effects are liable to follow.

In the treatment of large pigs, sows and boars, the dose of sodium fluoride should be divided, half being given in the morning, and the balance in the evening. In the case of such animals the food is often rapidly consumed, and the ingestion of a full dose of sodium fluoride in a short space of time may provoke violent vomiting. This does not occur when the dose is divided.

It is usual to starve the pigs overnight (allowing no food on the previous evening) prior to treatment, but this procedure is probably unnecessary.

Following treatment, worms do not usually make their appearance in the droppings for two to three days, and may continue to be passed out until the eighth or ninth day.

The efficiency of sodium fluoride for the expulsion of round worms from the small intestine of the pig is of a high order. In the treatment of small groups of pigs experimentally, it frequently reaches 100 per cent., and under field conditions, it can usually be relied upon to expel 85-90 per cent. of the parasites.

When the drug is given in medicinal doses, apart from the passage of soft faeces and mild vomiting in a few cases, no ill effects need be anticipated. Amongst large numbers of pigs included in field trials no deaths resulting from treatment have been recorded. The gradual consumption of the treated food apparently provides an adequate safeguard against the toxic effects of sodium fluoride, and in addition should an excessive amount of the drug be consumed, vomiting is induced, so providing a further safeguard.

The evidence now available indicates that sodium fluoride, when given in the recommended dosage is a safe and highly effective drug for the treatment of worms in pigs, and its use is consequently recommended.

In general, it will be found necessary only to treat weaners and slips, and this should be practiced as a routine procedure on properties where infestation is known to exist.

Other drugs recommended for the treatment of infested pigs include oil of chenopodium and phenothiazine, but these are not nearly as effective or reliable as sodium fluoride.

Oil of Chenopodium.

This should be given with or followed by a purgative such as castor oil.

The following mixture is recommended:—

Oil of chenopodium—1 fluid ounce.

Castor oil—25 fluid ounces.

The mixture should be administered at the rate of one fluid ounce per 25 pounds of live weight. A single dose cannot be relied upon to remove all of the parasites, and a second treatment should be given after an interval of 10 days has elapsed. The pigs should be starved for 24 hours before treatment. Pigs under the age of six weeks should not be treated. The drench may very conveniently be administered by means of a metal sheep drenching gun which may be set to deliver the required dose. During treatment, young pigs may be held in an upright position with the buttocks resting on the ground between the knees of an assistant. Should the treatment of larger pigs become necessary, these may be restrained by means of a running noose passing behind the tusks of the upper jaw, and secured to a strong post.

Phenothiazine.

This is a powdered drug which may be administered in the feed. The following dosage is advised:—

For pigs weighing 25 pounds	.....	$\frac{1}{8}$ ounce
For pigs weighing 25-50 pounds	.....	$\frac{1}{4}$ ounce
For pigs weighing 50-100 pounds	.....	$\frac{1}{2}$ ounce
For pigs weighing 100-200 pounds	.....	$\frac{3}{4}$ ounce
For pigs weighing over 200 pounds	.....	1 ounce

Prior to treatment the pigs should be starved overnight and then graded according to their size. They should be treated in small groups which will ensure that each animal consumes an approximately equal share of the food material offered.

According to the size and number of pigs in each group the required amount of the drug should be thoroughly mixed in an amount of food which will readily be consumed. As an example, weaners weighing 25 pounds could be treated in groups of six, allowing each group one ounce of phenothiazine incorporated in the feed. Treatment should be repeated after an interval of 10 days. Pigs under six weeks old should not be treated.

Following the administration of phenothiazine red coloured urine is excreted for a period of four or five days. This does not denote any interference with the health of the animal and need not cause concern.

PREVENTION AND CONTROL

On old established piggeries the soil becomes heavily contaminated with worm eggs. Consequently the young pigs which are highly susceptible are exposed to infestation from the time of birth. While treatment will remove the adult worms from the intestine it can have no effect upon the larval parasites which seriously damage the lungs and liver during their migration. It, therefore, becomes necessary to adopt preventive measures. Good sanitation, including the

drainage of yards with the object of keeping them dry, the daily removal of droppings, the provision of sties with concrete floors and of troughs which will prevent the animals feeding off the ground will assist in limiting the degree of infestation. Much better results will, however, be obtained if it is possible to completely protect the young pigs from infestation. The MacLean County system which has been extensively and successfully practised in the United States has this object in view. Its purpose is to prevent the exposure of the young pigs to infection from the time of birth until they are four or five months old.

The following procedure is adopted:—

Farrowing pens with concrete floors are provided. A few days before farrowing is due to occur the floor and walls are thoroughly cleansed by washing with a boiling five per cent. lysol solution (eight ounces to the gallon of water) applied with a hard broom. Immediately before being placed in the farrowing pen the sow is washed with a warm solution of soap and water, all mud and litter being removed, particular attention being paid to the cleansing of the udder and teats. This will remove any worm eggs which may be adhering to the body of the animal. Within 10 days of farrowing the sow and her litter are carted to a clean field or a field which has been sown with a green crop and has not been occupied by pigs within the past year. The matter may be placed on a very satisfactory basis if three pig paddocks can be made available and used in annual rotation. The paddock intended for the reception of sows and their litters should be cultivated and sown with a suitable green crop, the other two paddocks remaining vacant. On this basis each of the paddocks will be used every third year and will remain unoccupied during the remaining two years, when it may be used for the production of other farm crops. Under such a system of rotation and cultivation few worm eggs will remain viable and the young pigs may be carried to the age of four or five months without becoming seriously affected. Thereafter the animals, which are no longer highly susceptible, may be transferred to the old yards or sties for fattening purposes.

Better Dairying Competition, 1950-51

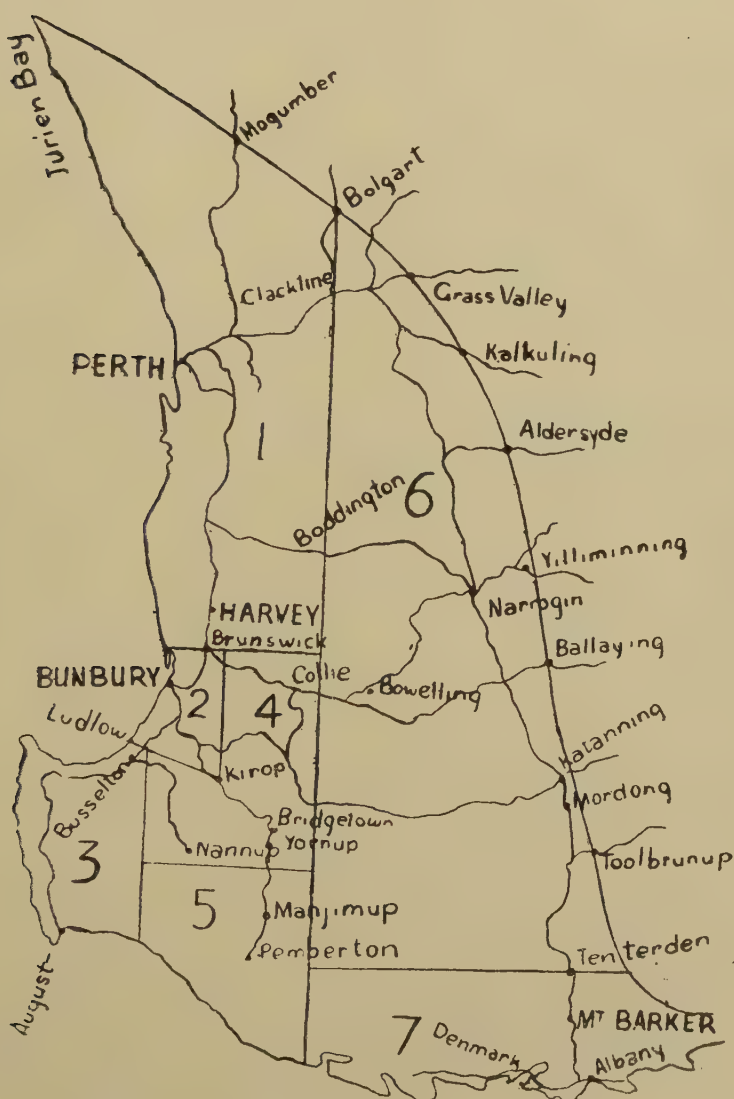
H. G. ELLIOTT, Asst. Supt. of Dairying.

R. A. BETTENAY, Agricultural Adviser.

The Australian Dairy Produce Board Pasture Improvement Committee (W.A.) again conducted a Better Dairying Competition during 1950-51 with a view to encouraging better dairying practices and in particular a greater conservation of fodder and improved pasture production.

For the purpose of the competition the South-Western Division of the State is divided into seven zones as shown in the accompanying map, namely:—

- Zone 1—Coastal.
- Zone 2—Bunbury, Donnybrook.
- Zone 3—Busselton, Margaret River.
- Zone 4—Bridgetown.
- Zone 5—Manjimup, Northcliffe.
- Zone 6—Great Southern.
- Zone 7—South Coastal.



Cash prizes were offered in each zone as follows:—First, £20 and framed certificate; second, £12; third, £8; fourth, £6.

In addition a championship prize for the best farm in the competition was awarded for the first time. This consisted of a month's conducted tour of the Victorian dairying areas.

Judging of the competition was performed by officers of the Dairy Branch of this Department, according to a scale of points previously drawn up by agreement between interested bodies.

The following scale of points was used in judging Zones 1-5 and 7:—

1. Conservation of fodder and summer crops	300 points.
2. Pastures	240 „
3. Dairy herd	120 „
4. Returns of butterfat, etc., per acre	120 „
5. Pigs	30 „
6. Farm management	140 „
7. Utilisation of skim milk	50 „
Total	1,000 „

Where a competitor sold his produce as whole milk no points were allotted for utilisation of skim milk, and the points scored were adjusted to bring the competitor to the same relative basis as the competitor who supplied butterfat to a factory.

The above scale of points was similar to that used in the previous year's competition but in section 4, returns of butterfat per acre, account was taken this year of the cost of purchased foodstuffs, chiefly concentrates, and a deduction was made on this account.

In Zone 6 the competition was on the basis of fodder conservation and sanitation with respect to the dairy herd and was judged on the following basis:—

Fodder conserved per dairy cow	100 points.
Hay—quality and condition	50 „
Use of phosphate supplements	25 „
Silage or summer fodder crops	50 „
Sanitation of dairy premises	25 „
Total	250 „

In order to facilitate judging and ensure as much uniformity as possible between judges, the scales shown were expanded within each section and these details are shown in Tables 1-7.

The total number of entries was much the same as in the previous year and was very pleasing. Zones 5 and 6, however, had a disappointingly low number of entries.

Entries judged in the various zones were as follows:—

Zone 1	....	....	....	12
Zone 2	....	....	....	15
Zone 3	....	....	....	13
Zone 4	....	....	....	10
Zone 5	....	....	....	5
Zone 6	....	....	....	2
Zone 7	....	....	....	15
				—
Total	....			72
				—

In all zones, other than Zone 6, it was necessary for the judge to visit each farm at least twice in order to get a proper appreciation of both winter pastures and fodder conservation and summer pastures and crops. These visits were firstly in October-November and again in December-January.

Details of the points allotted to competitors in the various zones are given in tables 1-7 respectively.

Successful competitors in the 1949-50 competition were handicapped on the basis of—

First prize winner	....	....	deduct 15 points.
Second prize winner	....	....	deduct 10 points.
Third prize winner	....	....	deduct 5 points.
Fourth prize winner	....	....	deduct 1 point.

Such deductions are shown at the bottom of each table.

Prize winners have been reported through the Press and are available from a perusal of Tables 1-7 where details of the points scored in each section by each competitor are set out.

TABLE 1
ZONE 1.—Judges, Messrs. H. Elliott and K. Needham.

	Maximum Points.	E. Rosher.	D. M. Webb.	A. W. Cunningham	W. Pethwick.	F. W. Leaver.	C. W. Ward.	N. L. and A. N. Marsh	J. E. Murray.	L. A. Jackman.	F. W. Godecke.	Dougall Bros.	J. England
1.— <i>Conservation of Fodder and Summer Fodder Crop</i> (300 points)													
(a) Hay, quality condition	40	34	32	34	36	37	35	37	35	35	36	36	...
(b) Baling	10	10	10	8	10	10	...	10	10	10	...	10	...
(c) Slage, Quality, Type, Wastage	25	...	...	...	20	20	20	...	...	...	...	...	...
(d) Summer Fodder Crops : Cultivation, disease, yield	25	15	18	16	...	20	...	20	20	...	22	...	20
(e) Amount conserved per cow	200	184	200	200	197	182	180	117	115	122	88	56	19
2.— <i>Pastures</i> (240 points)—													
(a) Density, condition, freedom from weeds, mixture, drought resistance, etc.	140	90	105	102	95	109	108	110	95	90	50	80	100
(b) Management, fertilisation	100	75	65	65	70	75	80	75	70	65	50	60	60
3.— <i>Dairy Herd</i> (120 points)—													
(a) Dairy type	50	37	26	36	31	28	22	31	32	33	27	16	19
(b) Condition	20	19	18	20	19	19	19	20	19	20	20	17	19
(c) Freedom from disease	20	18	17	18	18	17	18	19	17	19	18	17	18
(d) Herd Sire (1) Pure bred	20	18	...	20	18	20	20	20	19	20	20	...	...
(2) Ex tested dam	10	9	...	7	...	8	7	8	7	...	9	...	...
4.— <i>Returns per acre</i> (120 points)													
(a) Butterfat.....lb. per acre	100	64	80	51	43	28	42	42	27	24	28	28	41
(b) Sidelines (pigs, poultry, vegetables, etc.) £ per acre	20	16	16	...	1	6	7	1	10	10	4	6	4
5.— <i>Pigs</i> (30 points)													
(a) Breed, type and condition	10	...	...	...	...	...	...	...	...	9	...	...	...
(b) No. of breeding sows in proportion to Milch cows	10	...	...	...	...	...	...	...	...	9	...	...	...
(c) Housing, feeding and management	10	...	...	...	...	...	...	...	...	...	...	...	...
6.— <i>Farm Management</i> (140 points)													
(a) Lay out, convenience, etc.	50	36	40	36	37	40	45	36	38	35	30	35	40
(b) Sanitation	30	27	26	26	25	27	28	28	27	22	28	27	25
(i) General	...	...	...	...	...	...	...	...	...	...	...	...	...
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	39	30	36	36	35	35	35	36	23	40	34	30
(c) Book-keeping and records	20	18	18	15	17	18	15	15	18	15	15	10	15
7.— <i>Utilisation of Skim Milk</i> (50 points) Based on number of pigs and calves fed													
TOTAL	...	709	701	690	673	687	651	624	595	589	485	432	410
Adjusted	...	746	737	726	708	702	685	656	626	589	510	454	431
Less Handicap	...	741	722	716	707	702	685	656	626	589	510	454	431

TABLE 2
ZONE 2.—Judge, A. Sharp.

	Maximum Points.	R. C. Benson.	J. H. Bensted & Co.	B. W. H. Brett.	P. J. Edwards.	A. & R. Poad.	J. Jarvis.	Mrs. M. A. Crute.	Field Bros.	E. J. Stapleton.	A. C. Frost.	A. G. Moore.	G. P. & I. M. Manson.	E. W. M. Trigwell.	F. Martin.	G. Palmer.
1.— <i>Conservation of Fodder and Summer Crop</i> (300 points)—																
(a) Hay, quality, condition	40	37	35	35	33	35	35	27	32	33	28	30	32	30	...	...
(b) Baling, quality, condition	10	10	10	10	10	10	10	...	...	10	10	...	10	10	...	...
(c) Staging, quality, type, wastage	25	...	17	...	...	...	...	...	...	...	...	...	...	...	15	...
(d) Summer fodder crops: cultivation, disease, yield	25	22	18	...	...	18	...	18	10	...	...	...	...	80	60	...
(e) Amount conserved per cow	200	200	200	200	164	200	151	200	100	160	100	140	128	...	...	...
2.— <i>Pastures</i> (240 points)—																
(a) Density, condition, freedom from weeds, mixture, drought resistance, etc.	140	127	97	110	123	100	116	102	125	100	112	110	113	105	121	120
(b) Management, fertilisation	100	90	80	85	88	80	85	80	85	80	80	80	85	80	86	88
3.— <i>Dairy Herd</i> (120 points)—																
(a) Dairy type	50	25	30	31	24	24	29	20	23	14	23	19	18	26	23	26
(b) Condition	20	20	20	20	20	20	20	16	20	18	18	20	19	19	20	20
(c) Freedom from disease	20	20	19	19	19	19	20	16	19	17	17	20	18	18	19	18
(d) Herd Sire	20	18	19	18	13	19	...	19	20	18	18	19	19	19	19	19
(e) Pure bred	10	6	10	7	6	...	...	8	9	...	...	...	...	8	...	...
(f) Ex tested dam	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4.— <i>Returns per Acre</i> (120 points)—																
(a) Butterfat, lb. per acre	100	87	55	67	69	45	67	19	51	13	63	31	17	51	42	87
(b) Sidelines (pigs, poultry, vegetables, etc.), £ per acre	20	7	10	13	11	6	8	8	18	10	6	10	4	5	1	...
5.— <i>Pigs</i> (30 points)—																
(a) Breed, type, and condition	10	9	9	9	8	9	10	8	9	9	...	8	5	8	...	...
(b) Number of breeding sows in proportion to milch cows	10	7	8	8	5	8	9	7	10	10	...	1	8	8	...	...
(c) Housing, feeding, and management	10	7	8	8	7	9	10	...	8	7	...	5	8	7	...	...
6.— <i>Farm Management</i> (140 points)—																
(a) Layout, conveniences, etc.	50	40	45	45	40	35	30	40	40	40	45	40	30	35	40	48
(b) Sanitation:																
(i) General	30	25	25	27	25	30	30	30	25	25	25	25	25	25	25	27
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	40	35	30	25	40	40	35	33	25	35	30	40	35	35	35
(c) Book-keeping and records	20	17	20	16	12	17	17	20	19	18	18	15	10	16	10	16
7.— <i>Utilisation of Skim Milk</i> (50 points)—																
Based on number of pigs and calves fed	50	30	48	50	50	36	40	32	50	50	4	22	32	26	...	...
TOTAL	...	844	818	808	793	760	717	713	706	657	602	635	613	611	516	504
Less Handicap—Whole Milk Adjustment	...	839	808	793	768	760	716	713	706	657	641	625	613	611	561	548

TABLE 3
ZONE 3.—Judge, P. Travers-Drapes.

	Maximum Points.	G. Blakie	J. H. Oldfield.	J. Thomson.	W. D. Patmore.	A. W. Gersbach.	E. Cuthbert.	A. W. Dempster.	N. A. Smith.	F. Waterson.	G. M. Smith.	C. Armstrong.	T. Price.	D. T. Jones.
1. <i>Conservation of Fodder and Summer Fodder Crop (300 points)</i>														
(a) Hay, quality, condition	40	32	28	32	28	23	28	20	31	26	28	29	22	28
(b) Baling	10		10		10		10	10	10	10	10	6		6
(c) Silage, quality, type, wastage	25													
(d) Summer fodder crops: Cultivation, disease, yield	200	200	200	171	170	200	166	160	115	137	88	132	163	51
(e) Amount conserved per cow														
2. <i>Pastures (240 points)</i>														
(a) Density, condition, freedom from weeds, mixture, drought resistance, etc.	140	138	115	114	119	100	97	95	113	117	107	89	40	87
(b) Management, fertilisation	100	80	80	76	75	58	50	52	78	60	54	50	45	56
3. <i>Dairy Herd (120 points)</i>														
(a) Dairy type	50	28	21	23	10	16	21	21	22	17	17	19	23	16
(b) Condition	20	18	18	18	18	18	17	18	18	18	17	17	18	18
(c) Freedom from disease	20	17	17	18	19	10	16	18	18	19	17	17	17	18
(d) Herd Sire (1) Pure bred	20	19	17	19	18	19	19	18	19	18	18	18	20	15
(d) Herd Sire (2) Ex tested dam	10	8	10	10	10		6		6		7	9	2	
4. <i>Returns per Acre (120 points)</i>														
(a) Butterfat lb. per acre	100	100	52	59	51	37	50	49	40	38	44	45	47	50
(b) Sidelines (pigs, poultry, vegetables, etc.) £..... per acre	20	7	4	4	7	2	3	6	5	4	20	3	2	3
5. <i>Pigs (30 points)</i>														
(a) Breed, type and condition	10	7	6	9	8		8	8	7	8	7	8	8	8
(b) Number of breeding sows in proportion to milch cows	10	5	5	8	5		8	8	5	8	10	2	5	2
(c) Housing, feeding and management	10	4	8	9			6	8	7	6	6	6	6	6
6. <i>Farm Management (140 points)</i>														
(a) Lay-out, convenience, etc.	50	40	45	35	40	30	25	40	40	37	30	35	25	40
(b) Sanitation:														
(i) General	30	25	25	18	20	28	18	25	20	20	20	25	28	20
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	28	30	25	25	37	20	25	25	38	25	30	30	30
(c) Book-keeping and records	20	18	16	18	15	16	17	12	19	18	18	18	10	16
7. <i>Utilisation of Skin Milk (50 points)</i>														
Based on number of pigs and calves fed	50	32	33	46	22	6	35	39	31	21	30	16	23	22
TOTAL		791	740	712	677	623	640	632	629	620	586	584	536	492
Whole Milk Adjustment		801				656			629					
Less Handicap		786	740	712	677	656	640	632	629	620	586	584	536	492

TABLE 4

ZONE 4.—Judge, C. D. Sharp.

	Maximum Points.	S. C. Maidment.	H. A. Dowerick.	M. Brennan.	H. B. Ellis.	K. M. Chapman.	H. H. Daniels.	C. N. Warren.	G. E. White.	A. F. Hewett.	W. Guy.
1.— <i>Conservation of Fodder and Summer Fodder Crop</i> (300 points)—											
(a) Hay, quality, condition	40	36	34	34	32	30	30	30	30	30	28
(b) Baling	10	10	10	10	10	...	7	10	10	10	5
(c) Silage, quality, type, wastage	25	25	...	...	...	15	...	22	...	...	...
(d) Summer fodder, crops : Cultivation, disease, yield	25	200	...	...	168	160	80	64	53	60	64
(e) Amount conserved per cow	200	200	200	128	...	...	...	...	...	...	...
2.— <i>Pastures</i> (240 points)—											
(a) Density, condition, freedom from weeds, mixture, drought resistance, etc.	140	120	115	110	105	110	95	94	100	95	85
(b) Management, fertilisation	100	95	80	85	80	75	80	72	80	75	70
3.— <i>Dairy Herd</i> (120 points)—											
(a) Dairy type	50	27	20	28	22	26	23	21	20	17	21
(b) Condition	20	20	18	19	18	19	17	19	18	17	17
(c) Freedom from disease	20	17	18	19	18	17	18	19	17	17	17
(d) Herd Sire (1) Pure bred	20	20	20	18	17	20	18	18	18	16	16
(2) Ex tested dam	10	10	10	10	10	9	...	7	8	6	6
4.— <i>Returns per Acre</i> (120 points)—											
(a) Butterfat, ...lb. per acre	100	37	32	100	41	18	39	33	66	30	34
(b) Sidelines (pigs, poultry, vegetables, etc.), £..... per acre	20	20	13	4	8	10	9	9	3	5	9
5.— <i>Pigs</i> (30 points)—											
(a) Breed, type, and condition	10	7	...	...	7	...	7	8	...	7	7
(b) Number of breeding sows in proportion to milch cows	10	8	...	...	8	2	8	7	...	8	10
(c) Housing, feeding, and management	10	8	...	...	7	...	7	6	...	6	6
6.— <i>Farm Management</i> (140 points)—											
(a) Layout, conveniences, etc.	50	43	40	36	32	36	30	30	37	34	30
(b) Sanitation :											
(i) General	30	26	24	25	23	25	24	25	24	26	22
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	36	30	32	30	32	30	31	31	35	28
(c) Book-keeping and records	20	20	18	15	16	12	15	17	15	16	12
7.— <i>Utilisation of Skim Milk</i> (50 points)—											
Based on number of pigs and calves fed	50	50	30	12	25	25	33	26	9	20	36
TOTAL	...	885	714	685	677	641	570	568	539	534	523
Less Handicap	...	820	704	680	677	641	570	568	539	534	523

TABLE 5

ZONE 5.—Judges, Messrs. J. McNally and K. Needham.

	Maximum Points.	J. Bashford.	A. J. S. Angel.	W. Della & Sons.	M. Britza.	A. E. Booth.
1.—Conservation of Fodder and Summer Fodder Crop (300 points)—						
(a) Hay, quality, condition	40	32	35	30	25	30
(b) Baling	10	.....	.....	.....	10	10
(c) Silage, quality, type, wastage	25	.....	15	.....	.....	.....
(d) Summer fodder crops: Cultivation, disease, yield	25	.....	12	.....	.....	.....
(e) Amount conserved per cow	200	200	200	104	69	67
2.—Pastures (240 points)—						
(a) Density, condition, freedom from weeds, mixture, drought resistance, etc.	140	121	110	107	95	99
(b) Management, fertilisation	100	90	75	80	73	75
3.—Dairy Herd (120 points)—						
(a) Dairy type	50	25	28	21	15	12
(b) Condition	20	20	20	20	20	20
(c) Freedom from disease	20	20	20	12	20	20
(d) Herd Sire (1) Pure bred	20	20	20	20	20	.....
(2) Ex tested dam	10	2	7	10	6	.....
4.—Returns per Acre (120 points)—						
(a) Butterfat, ...lb. per acre	100	88	39	66	25	33
(b) Sidelines (pigs, poultry, vegetables, etc.), £..... per acre	20	4	13	16	8	8
5.—Pigs (30 points)—						
(a) Breed, type, and condition	10	10	9	8	.....	10
(b) Number of breeding sows in proportion to milch cows	10	8	8	5	.....	10
(c) Housing, feeding, and management	10	9	5	6	3	8
6.—Farm Management (140 points)—						
(a) Layout, convenience, etc.	50	45	35	30	42	30
(b) Sanitation :						
(i) General	30	27	26	23	28	20
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	35	35	20	37	25
(c) Book-keeping and records	20	20	20	20	20	5
7.—Utilisation of Skim Milk (50 points)—						
Based on number of pigs and calves fed	50	44	.....	50	20	50
TOTAL .....	.....	820	732	648	536	532
Whole Milk Adjustment .....	.....	.....	771	.....	.....	.....
Less Handicap .....	.....	805	770	638	536	532

TABLE 6

POINTS GAINED BY COMPETITORS IN ZONE 6, GREAT SOUTHERN.

Judge, R. E. McCallum.

	Maximum Points.	Miss E. Kelliher.	Messrs. De Houghton & Kennedy.
1. Fodder Conserved per Dairy Cow	100	61	40
2. Quality of Hay—			
(a) Mixture	20	8	8
(b) Palatability	10	6	6
(c) Time of cutting	10	7	4
(d) Aroma	5	4	3
(e) Baling	5	5	2
	— 50	— 30	— 23
3. Silage and Summer Fodder Crops	50	....	....
4. Use of Phosphatic Lick	25	....	....
5. Sanitation of Dairy Premises—			
(a) Drainage	5	3	4
(b) Cleanliness of Utensils	5	5	5
(c) Provision of Boiling Water	5	5	5
(d) General Layout	5	5	4
(e) General Hygiene	5	5	5
	— 25	— 23	— 23
TOTAL POINTS	250	114	86

TABLE 7
ZONE 7.—Judge, I. Miller.

	Maximum Points.	F. C. Smith.	L. P. Joyce.	Farr Bros.	W. Middleton.	T. C. Cooper.	W. Bradford.	A. J. Anning.	W. Wilde.	H. J. Shepherd.	L. Jordan.	L. Tysoe.	S. Ravenhill.	F. Worsfold.	F. Pfeiffer.	E. Mullaly.
1.—Conservation of Fodder and Summer Fodder Crop (300 points)																
(a) Hay, quality, condition	40	31	30	24	30	28	28	25	...	26	21	27	30	26	10	...
(b) Baling, quality, condition	10	...	...	9	10	...	10	...	...	7	...	...	...	...	...	...
(c) Silage, quality, type, wastage	25	18	...	19	...	...	...	17	...	...	...	19	18	21	...	17
(d) Summer fodder crops: Cultivation, disease, yield	200	21	200	184	128	180	128	144	100	144	136	96	66	27	62	2
(e) Amount conserved per cow	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
2.—Pastures (240 points)																
(a) Density condition, freedom from weeds, mixture, drought resistance, etc.	140	132	116	125	130	119	124	106	126	116	106	107	108	98	91	103
(b) Management, fertilisation	100	92	84	88	90	76	87	62	89	86	80	68	73	75	84	76
3.—Dairy Herd (120 points)																
(a) Dairy type	50	30	26	20	21	20	14	24	24	20	19	15	11	23	20	23
(b) Condition	20	18	18	19	18	18	18	18	18	17½	18½	17	18	18	17	18
(c) Freedom from disease	20	19	19	18	17	18	19	19	19	19	18	19	17	19	15	19
(d) Herd Sire (1) Pure bred	20	19	19	19	19	15	19	...	19	18	19	19	18	19	...	...
(d) Herd Sire (2) <i>Ex</i> tested dam	10	8	...	9	9	...	10	...	9	...	7	9	8	9	...	...
4.—Returns per Acre (120 points)																
(a) Butterfat, lb. per acre	100	57	45	31	57	44	36	58	87	33½	42½	31	41½	26	48	36½
(b) Stalkines (pigs, poultry, vegetables, etc.), £.....per acre	20	16	5	1	7	5	8	6	3	10	2	7	3½	3	3	4½
5.—Pigs (30 points)																
(a) Breed type and condition	10	9	9	8	9	8	9	8	9	5	7	9	8	8	4	9
(b) Number of breeding sows in proportion to milch cows	10	10	8	5	5	8	8	...	8	8	5	10	8	8	8	8
(c) Housing, feeding and management	10	9	10	6	6	7	7	7	10	6	6	8	7	6	5	8
6.—Farm Management (140 points)																
(a) Lay-out, convenience, etc.	50	47	46	40	42	39	43	43	43	45	39	43	44	40	39	43
(b) Sanitation:	30	26	26	20	23	24	22	23	26	22	24	22	22	22	22	23
(i) General	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
(ii) Milking shed, dairy, dairy utensils, and care of cream and milk	40	38	38	28	32	27	26	31	31	28	29	29	28	31	27	31
(c) Book-keeping and records	20	18	19	10	11	11	11	12	14	10	14	14	14	10	10	15
7.—Utilisation of Skim Milk (50 points)																
Based on number of pigs and calves fed	50	50	26	36	50	50	50	50	14	18	36	8	16	44	24	28
TOTAL	...	868	745	719	714	697	677	663	649	638	625	579	556	532	489	454
Less Handicap	...	868	735	719	699	697	677	663	649	638	625	579	556	532	489	454

Championship Winner.

The State Championship prize was selected from amongst the zone winners by the Superintendent of Dairying, Mr. M. Cullity, and the Chairman of the Australian Dairy Produce Board, Pasture Improvement Committee, Mr. R. H. Rose. Mr. F. C. Smith, of Denmark, was placed first, followed by Mr. E. Rosher, of Bassendean, and Mr. J. Bashford, of Northcliffe.

The winner has a well established farm on 125 acres of karri hill country carrying a well balanced perennial pasture. An efficient rotational grazing together with a rotational cropping programme is practised and coupled with careful stocking, results in very satisfactory per cow and per acre production. The farm is very well laid out and maintained in a very neat and tidy condition.

As in past years a good deal of valuable information was obtained by the judges in the course of the present competition. The farms entered in the competition are perhaps slightly better than the majority of dairy farms in the South-West, but nevertheless from an analysis of the figures, together with the comments of the judges, some idea of the present position of the dairy industry in this State can be obtained. By comparing findings in the present year with those of earlier competitions some indication of trends can be had. The following analysis and discussion is intended to indicate such trends as occur and to draw attention to the results being obtained by the more efficient farmers who entered the competition.

FODDER CONSERVATION

General.

An idea of the importance attached to fodder conservation and pastures can be obtained from Tables 1-7 in which it is shown that of the 1,000 points possible, 300 are allotted for fodders and fodder conservation and a further 240 for pastures. That is, 54 per cent. of the maximum points are allotted for quantity and quality of feed available to the stock.

Maximum points for fodder conservation can be obtained if two and a half tons of hay, or its equivalent as silage or summer crop, is conserved per dairy cow. For the purpose of computation three tons of silage or summer crop is considered equivalent to one ton of hay. Where a farm had an area of summer pasture full points were given for less than two and a half tons of hay equivalent per cow on a sliding scale basis.

Need for Fodder Reserves.

The climate of the South-Western portion of this State is such that there is a great bulk of feed in the spring, but little growth of pastures except in localised moist or irrigated areas during the summer months. During this time it is necessary to practice some form of supplementary feeding if production is to be maintained. Many farmers outside of the milk zone dry-off their herds for several months during late summer and consider that by this method they overcome the need for fodder conservation. There are several fallacies in this line of reasoning.

In the first place, although it is considered desirable from a production point of view to calve cows down in April and May there are always a number that do not take when first served or which for some other reason do not calve until July or August. Such cows should not be dried off in January and February, but should be milked through to complete a nine or 10 months lactation. They can only continue in production if supplementary feeding is practised at this period.

In the second place a cow that has milked for nine or 10 months and which is due to calve again in several months time needs to be well fed during her dry period in order to nourish the growing foetus and to replenish her depleted body reserves. It is well known that a cow should be in rising condition during the period prior to calving for best milk production during the coming lactation. All too many farmers neglect their dry cows at this time of the year when some form of supplementary feeding would pay dividends during the coming lactation.

With the break of the season, full supplementary feeding should be continued as the total bulk of feed is very low at this period and also since it is desirable at this time to give the young annual pasture seedlings an opportunity to become established before they are heavily grazed. The necessity for hand feeding then becomes less in most districts until the onset of cold weather in June and July when pastures make little growth, and hand feeding is again desirable. This stage is followed by the period of maximum growth and a great bulk of feed in the spring when hand feeding is not necessary and there is a surplus of feed which should be conserved whilst still in a palatable and nutritious form.

Thus we have several periods of the year when hand feeding is desirable, namely:—

1. **December to March.**—During this period pastures are dry and becoming sparse. Hay may be fed, but for milk production it is desirable to feed also a supplement in the form of silage or a summer grown crop.

2. **April and May.**—With the opening rains the need for silage diminishes and hay is very desirable to supplement the nutritious but "soft" grasses and to supply bulk.

3. **July and August.**—Further supplementary feeding of hay is desirable.

During these three periods consideration has to be given to the necessity for feeding all stock, including milking cows, calves and yearlings, bulls and horses. It has been shown that a quantity equivalent to two and a half tons of hay per cow supplies a margin sufficient for the feeding of other stock usually found on a dairy farm and this quantity was therefore used as the amount which would be needed by competitors to gain maximum points. It should be the aim of every dairy farmer to conserve this amount of hay equivalent every year. As previously mentioned for purposes of comparisons three ton of silage or summer fodder is considered equivalent to one ton of hay.

TOTAL QUANTITY CONSERVED

Average fodder conservation as hay, silage and summer crop are shown in Table 8 according to zone. It will be noticed that zones are rather similar with the exception that summer fodder crops are much more general in Zone 1 which includes the whole milk districts.

TABLE 8

FODDER RESERVES.—COMPARISON OF ZONES AND WINNERS IN EACH ZONE.

Zone.	Total Cows.	Hay.	Silage.	Green Fodder.	Reserve per Cow.			Reserve per Cow calculated as Hay.
					Hay.	Silage.	Green Fodder.	
		tons.	tons.	tons.	tons.	tons.	tons.	tons.
1. Coastal	674	824	84	1,127	1.22	0.12	1.67	1.82
Rosher, E.	84	97	....	156	1.15	....	1.86	1.78
2. Bunbury-Donnybrook	529	606	24	311	1.15	0.04	0.51	1.36
Benson, R.	31	42	....	85	1.35	....	2.74	2.26
3. Busselton-Margaret River	527	749	....	104	1.42	....	0.20	1.49
Blaikie, G.	33	45	....	....	1.36	....	....	1.36
4. Bridgetown	322	463	100	13	1.44	0.31	0.04	1.56
Maidment, S. C.	62	85	70	....	1.37	1.13	....	1.74
5. Manjimup-Northcliffe	191	225	139	10	1.18	0.07	0.04	1.44
Bashford, J.	36	105	....	....	2.92	....	....	2.92
7. South Coastal	396	455	99	218	1.15	0.25	0.55	1.42
Smith, F. C.	30	37	87	100	1.23	2.90	3.33	3.30
All Zones, 1950-51	2,639	3,322	446	1,783	1.26	0.17	0.68	1.54

The average reserves of hay, silage and summer feed per cow were:—

1.26 tons of hay.

0.17 tons of silage.

0.68 tons of green feed.

This is equivalent to 1.54 tons of hay equivalent, a figure very similar to that of the 1949-50 competition (1.52 tons) and the 1948-49 competition (1.52 tons). In the three years period there has been a steady decline in silage conservation which has been compensated by an increase in hay whilst summer fodder crops have not shown any trend.

It is pleasing to note that 16 of the 70 competitors in the dairying area proper obtained maximum points for amount of fodder conserved. It is significant that these competitors also scored well in other sections such as production per cow and per acre.

Conservation of Hay.

Fodder conservation as hay accounted for the great bulk of all fodder conserved and has shown a slight increase over the past three years. At 1.26 tons per cow the amount must be considered quite satisfactory although still below the desired amount. Of the total amount, 81 per cent. was meadow or clover hay (yield 1.8 tons per acre) and 19 per cent. cereal hay (yield 1.9 tons per acre).

A pleasing feature is the ever increasing trend towards great mechanisation. In the present competition 42 entrants (60%) baled at least a portion of their hay and most of these baled the whole of the hay conserved.

Quality of the hay was not quite up to standard in the present competition on many farms. This was brought about mainly by unfavourable weather conditions and rain during the critical period and by the shortage of labour. However, in addition some farmers appear to consider baling to be a cure-all and that as long as the hay is baled the stage of cutting and length of time the crop is let lie before baling are of minor importance. This is far from being the case and baling can not improve quality once hay has deteriorated. If a baler is unavailable at the critical time it is better to go ahead and mow the pasture and get it stacked at the right stage rather than to leave it in the paddock until a contract baler is available to handle it.

Conservation of Silage.

Conservation of silage showed a further decline on the already low figure of last year, being 0.17 tons per cow. Only 10 competitors conserved any silage and on most of these farms the amount was small. This is an unfortunate trend and has been brought about by the present shortage of labour. As has been mentioned earlier, silage is a very valuable contribution to production during the summer and early autumn months when all pastures are dry.

Many farmers do not realise that silage-making need not be a strenuous time-consuming job and several farmers in the South-West have been very successful at this venture.

Silage-making need not interfere with hay-making as the pasture should be cut at a less mature stage and is not affected by rain. With proper organisation, silage-making should commence some 3-5 weeks before hay-making is due to start and the same equipment and labour can then be used for hay-making thus permitting a longer season for conserving fodder than with hay-making alone.

SUMMER FODDER CROPS

Of the 70 competitors, 28 grew some form of summer fodder crop, bringing the average figure for fodder from this source to 0.68 tons per cow. This is higher than in either of the two previous years and in part makes up for the lower conservation of silage.

TABLE 9
ACREAGE OF GREEN FODDER FOR COWS.

Zone.	No. of Cows.	Summer Fodder.	Acres Sown per Cow.
		acres.	
1. Coastal	674	138	0.21
2. Bunbury-Donnybrook	529	43	0.08
3. Busselton-Margaret River	527	17	0.03
4. Bridgetown	322	9	0.03
5. Manjimup-Northcliffe	191	2	0.01
7. South Coastal	396	13	0.03
TOTAL	2,639	222	0.08

Table 9 gives information on the area sown in the various zones and the acreage sown per cow. It will be seen that Zone 1 is the only zone in which summer fodder crops reach satisfactory levels. This area includes the whole milk zone and indicates that farmers in the area realise the importance of summer fodders for summer milk production. Eight of the 12 competitors in this zone grew summer fodder crops; three of the remaining four conserved some silage and the other one was not a supplier of whole milk.

TABLE 10
KIND AND ACRES OF GREEN FEED.

Kind of Feed.	ZONE.						Total.
	1.	2.	3.	4.	5.	7.	
Maize	9	6	7½	....	1	12¾	36½
Sudan	88	11½	9	2	1	....	111½
Millet	16½	25½	½	5	....	....	47½
Lucerne	5½	....	....	2	....	¼	7¾
Melons	19	....	....	....	....	....	19
Total Acreage for Zone	138	43	17	9	2	13	222

The principal crops grown can be seen in table 10. Sudan grass occupies pride of place so far as acreage is concerned and is followed in turn by millet and maize. Only a small acreage of lucerne is grown. The large area is devoted to Sudan grass and millet, since these are grazing crops which do not require cutting.

There is ample scope for more attention to the growing of summer fodder crops and the success of many of those who attempted to grow them indicates that summer fodder crops can be grown satisfactorily when the correct agricultural practices are followed. Early ploughing and cultivation in conjunction with adequate fertilisation and sowing at the right time have been proved to give profitable crops even in what is not considered summer land.

It has been estimated that a desirable level of feeding of green fodder in the five dry months is a daily ration of 40 lb. With a crop of 10 tons per acre this would be approximately 0.3 acres per cow. This desirable level was approached in Zone 1 (0.21 acres per cow) but no other zone got to anywhere near this figure. Where silage is provided the quantity of green feed needed would be reduced and on farms having moist land and irrigated pasture the minimum required is further reduced.

PASTURES

General.

Almost all annual pastures in the dairying districts now have subterranean clover as a basis. Unfortunately not enough farmers realise that a clover by itself does not form a balanced and stable pasture. Unless steps are taken to introduce a satisfactory grass, the pasture is likely to degenerate within a few years by the invasion of weeds and some of the less nutritious blade grasses. Wimmera ryegrass is considered the most suitable annual grass for inclusion with subterranean clover to form a balanced pasture in the drier land throughout these areas. On much of the land used for dairying in the South-West, *Phalaris tuberosa*, kikuyu or perennial ryegrass may be grown successfully, and, being perennial, they come away much earlier after rain and so give a good early pick, similarly they remain green longer at the end of the season and so extend the growing season.

Kikuyu is a grass which is receiving more and more favourable attention and it has now spread very markedly throughout many districts, especially in Zones 1, 2 and 3 along the coastal plain.

With a few exceptions, farmers are still not paying sufficient attention to renovation of pasture and under these conditions it is difficult to retain a good balanced sward of high palatability. The ideal is to spread animal droppings with pasture harrows every year soon after the opening rains, and at least twice again during the winter months.

Practices regarding superphosphate dressings adhere fairly generally to that recommended within the limits set by shortage and inability to obtain supplies. On annual pastures the recommendation is to supply super. at the rate of two cwt. per acre in the autumn. This should be applied before, or very shortly after, the opening rains. Some farmers are still giving both autumn and spring applications but this is considered uneconomical from the labour point of view except on areas in the extreme south and on lands that become waterlogged in the winter.

Heavier dressings of super. in the order of 3-4 cwt. are recommended on moist summer land and irrigated pastures, applied part in autumn and part in spring.

Many farmers use copperised super. every third or fourth year; this is essential in those districts where the deficiency occurs.

TABLE 11
ACRES UTILISED PER MILCH COW.

ACRES UTILISED PER MILCH COW.																																			
Average Number of Cows in Herd.														Acres Devoted to Dairying.										Acres per Cow.											
1950-51.		1949-50.		1948-49.		1935-36.		1934-35.		1933-34.		1950-51.		1949-50.		1948-49.		1935-36.		1934-35.		1933-34.		1950-51.		1949-50.		1948-49.		1935-36.		1934-35.		1933-34.	
Zone 1	56	51	36	41	36	259	234	212	172	89	124	4.6	4.6	4.6	4.1	4.1	4.7	4.5	3.6	3.6	3.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Zone 2	35	33	34	29	36	154	136	140	213	118	245	4.4	4.4	4.4	4.3	4.3	4.8	5.4	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Zone 3	41	31	33	22	23	21	184	134	146	100	93	4.5	5.0	5.0	4.3	4.3	4.8	5.4	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Zone 4	32	31	33	22	23	26	195	137	154	125	134	6.0	5.0	5.0	5.3	5.3	4.8	5.4	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Zone 5	38	28	31	33	24	21	152	133	125	86	77	4.0	4.7	4.7	3.1	3.1	3.6	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
Zone 6	26	24	26	20	18	111	105	122	....	89	55	4.2	4.4	4.4	4.7	4.7	....	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	
Average	37.7	34.3	37.0	33.5	27.7	26.3	1,742	159.0	163.5	144.1	118.6	4.6	4.6	4.6	4.4	4.4	4.3	4.1	4.1	4.7	4.7	4.7	4.7	4.6	4.6	4.6	4.4	4.4	4.3	4.3	4.1	4.1	4.7	4.7	

Carrying Capacity.

Carrying capacity may be defined in a number of ways, but for the purpose of comparison between farms and between years has been taken in the Better Dairying Competition as the area on the farm devoted to dairying divided by the number of cows in the herd. Table 11 sets out the areas utilised per milch cow according to zone and compares the 1950-51 figure to that of a number of earlier years. From it we see no trend in number of acres per cow, the figure having remained fairly constant at around 4.6 acres. This method of stating carrying capacity does not take into account the other stock grazing on the same pasture, such as calves and yearlings for replacements.

From table 11, we also see that the size of farm has increased during the past few years, chiefly by clearing of additional areas. This has permitted the average number of cows per herd to become larger.

Data collected from all farms show the number of the various classes of stock as below:—

Cows (milking or dry)	....	....	....	2,770
Yearlings—				
(i) Heifers	....	....	....	1,025
(ii) Others	....	....	....	89
Calves—				
(i) Heifers	....	....	....	848
(ii) Others	....	....	....	229
Bulls	....	....	....	90
Horses	....	....	....	149
				5,200

These figures show the carrying capacity as 2.3 acres per head of all classes of stock, a similar figure to that of the last two competitions.

Carrying capacity as a measure of productivity of the pastures should include some consideration of production per cow pastured on the area, production per acre and expenditure on purchased foodstuffs. These are all considered in the next section.

DAIRY HERDS AND PRODUCTION

Dairy Type.

As in the previous competition, dairy type was assessed entirely upon production, and appearance of the animals was not taken into account. Maximum points were allotted to a herd averaging 400 lb. of butterfat per annum and a lesser number of points, according to a scale previously furnished to the judges for herds with lower production.

TABLE 12
Average Yield per Cow

Year	Number of Cows	Average Yield per Cow Butterfat (lb.)
1950-51	2639	235.5
1949-50	2748	237.6
1948-49	1964	232.9
1935-36	2109	212.0
1934-35	1550	192.7
1933-34	1663	208.8
1932-33	1531	201.5

In Table 12 average yield per cow is shown and compared to that obtained in previous competitions. It will be seen that there has been little change in the last three years although the average is higher than obtained by competition entrants in the 1930's.

TABLE 13

AVERAGE PRODUCTION PER COW IN EACH ZONE TOGETHER WITH THAT OF THE HIGHEST PRODUCING HERD.

	1950-51.			1949-50.	1948-49.	1935-36.
	Total No. of Cows.	Average per Herd.	Average Butterfat per Cow.			
1. Coastal	674	56	267.0	238.2	270.0	233.4
A. Cunningham	58	....	357.0	....	....	....
2. Bunbury-Donnybrook	529	35	237.0	244.1	203.8	205.0
B. W. H. Brett	38	....	308.0	....	....	....
3. Busselton-Margaret River	527	41	200.4	241.7	235.8	260.0
G. S. Blaikie	33	....	280.0	....	....	....
4. Bridgetown	322	32	214.7	231.8	220.8	229.1
M. Brennan	34	....	245.0	....	....	....
5. Manjimup-Northcliffe	191	38	198.6	244.3	214.3	179.6
A. J. S. Angel	36	....	276.0	....	....	....
7. South Coastal	396	26	259.5	229.1	214.0	...
F. C. Smith	30	....	299.0	....	....	....
All Zones	2,639	37.7	235.5	237.6	232.9	212.0

The table is enlarged for the year under review in Table 13 in which average production in each unit is compared to that of the leading herd. Zone 1 had highest production followed by Zone 7, with a big drop to Zone 2 in third position.

In all zones the winning herd had very much better per cow production than the average of the zone.

TABLE 14

HERDS PRODUCING MORE THAN 250 lb. BUTTERFAT PER COW, 1950-51.

Owner.	Zone.	Number of Cows in Herd.	Breed.	Production of Butterfat per Cow.
A. Cunningham	1	58	F	357
L. Jackman	1	16	F	326
J. E. Murray	1	23	J	318
N. L. and A. N. Marsh	1	80	AIS	309
B. W. H. Brett	2	38	J	308
W. Pethwick	1	52	AIS	305
J. H. Bensted & Co.	2	22	AIS	301
F. C. Smith	7	30	JX AIS	299
E. Rosher	1	65	G X F	296
J. Jarvis	2	22	J	293
G. S. Blaikie	3	33	AIS	280
A. J. S. Angel	5	38	G	276
F. W. Godecke	1	75	AIS	266
G. Palmer	2	33	AIS	263
F. W. Leaver	1	90	AIS	262
E. M. Webb	1	20	AIS	261
E. W. M. Trigwell	2	39	J	258
L. P. Joyce	7	16	G	258
R. Benson	2	31	J	251

Herds producing more than 250 lb. per cow are shown in order in Table 14. It will be noticed that Mr. A. Cunningham, of Armadale, once again topped this list. He was followed in turn by L. Jackman, of North Dandalup, and J. E. Murray, of Armadale.

TABLE 15.

Herds Supplying Whole Milk Zone 1.
Average Yield of Milk per Cow.

Name	No. of Cows.	Total Yield (gals.)	Av. Yield (gals.)
Rosher, E.	65	48,037	739.0
Webb, E. M.	20	13,077	653.8
Cunningham, A. W.	58	51,848	893.9
Pethwick, W. R.	52	39,607	761.7
Leaver, F. L.	90	59,032	655.9
Ward, W. A.	40	22,016	550.4
Marsh, N. L. & A. N.	80	61,813	772.7
Murray, G. E.	23	18,289	795.2
Godecke, F. W.	75	49,846	664.6
Dougall Bros.	100	47,724	477.2
England, J. E.	55	25,524	464.1
*Total for Zone	658	436,903	664.0

* Excluding one herd producing butterfat and fresh cream.

In Table 15 Herds in Zone 1 supplying whole milk are tabulated showing the yield of milk in gallons. Here again A. Cunningham's Friesian herd has topped the competition with 894 gallons of milk per cow. This is a decline of 43 gallons per cow over his production in the previous year, brought about by labour difficulties and sickness in the family. He is followed in turn by J. E. Murray of Armadale, and N. L. and A. N. Marsh with Jersey and A.I.S. herds respectively. L. Jackman, who was second to A. Cunningham for butterfat production did not produce whole milk for sale as such and so does not appear amongst the competitors in Table 15.

Average production of whole milk supplies was 664 gallons, a gratifying increase of 73 gallons over that of the previous year and very similar to the 1948-49 figure, as shown in Table 16.

TABLE 16.
Average Yield of Milk (gal.) per Cow.
Coastal—Zone 1.

Year.	Average Yield.
1950/51	664.0
1949/50	591.5
1948/49	675.0
1935/36	583.0*
1934/35	540.0*
1933/34	552.0*
1932/33	414.0*

* Converted from butter fat averages as published for earlier competitions to a 4 per cent. milk.

PRODUCTION PER ACRE

Concentrates Purchased for Cows.

Production of butterfat per acre was assessed in a different manner to that in all previous competitions. In the present competition farmers were required to make a declaration stating the amount spent on purchased fodders and concentrates fed to cows during the 12 months. This amount was then converted into an equivalent of butterfat at 3s. per lb., and this amount of butterfat was deducted from the total butterfat production of the farm to give an estimate of the butterfat actually produced from pasture and home grown reserves.

TABLE 17
Concentrates Purchased for Cows.

Zone	Average Amount per Herd	Average Amount per Cow
	£	£
1	728	12.9
2	195	5.5
3	71	1.8
4	104	3.2
5	220	5.7
7	109	4.1
All Units	£233.9	£6.2

The average amount spent on purchased concentrates in each zone is shown in Table 17. It will be seen that the amount spent per herd varied from the very high average of £728 in Zone 1 to the figure of £71 per herd in Zone 3. Individual farms showed much greater variation. Average amount spent per milking cow varied from £12.9 in Zone 1 to £1.8 in Zone 3.

The very large amount spent on purchased fodders by some farmers is a matter of some concern. It is felt that with good dairying practices and fodder conservation it should be possible to grow sufficient fodder to make purchased fodders a minor item of the farm budget. It will be noted from Table 17 that Zone 1 has very much higher cost of purchased concentrates than any of the other zones. This is to be expected from herds producing whole-milk for sale as such as these herds have to keep producing at a high level during the summer months, and also since the higher returns for their products make greater feeding an economic proposition.

Production Per Acre.

Average production of butterfat per acre for each zone and for the leading herd in this respect in each zone, is shown in Table 18. Butterfat production per acre averaged 39.3 lb. over all zones after deductions had been made for purchased concentrates.

This figure would appear to be rather low, but it should be realised that two of the factors contributing to the low figure are:—

(1) Stock other than cows in milk are grazing on the area concerned. Additional stock includes dry cows, calves and yearlings, bulls and horses or, in short, all animals necessary for the normal running of a complete dairy farm.

(2) Much of the land is only partially developed. Any land to which the herd has access is included in the total area devoted to dairying, and much of it is in the initial stages of development. Shortage of labour is a factor contributing to this.

Despite the labour shortage it is felt that more attention should be given to all aspects of pasture production including pasture renovation. By this means the carrying capacity could very readily be increased with a consequent lifting of production per acre.

As may be seen in Table 19, Mr. M. Brennan, third place getter in Zone 4, obtained 90.4 lb. of butterfat per acre after allowance had been made for purchased concentrates. This was a greater return from pastures than that obtained by any other competitor. Mr. Brennan farms a relatively small area of 94 acres of well improved hill country carrying 34 cows.

It will be noticed that the highest per acre production in each zone went to a farm with a relatively small area. This is to be expected and should be taken as an indication that few farms are yet fully developed. With improvements proceeding yearly, we can confidently expect some marked increase in production per acre over the next few years.

TABLE 18
PRODUCTION PER ACRE—1950-51.

Zone.	Acres Utilised per Milch Cow.	Average Production of Butterfat per Acre.	
		Corrected.	Uncorrected.
		lb.	lb.
Zone 1	4.6	36.8	57.8
Zone 2	4.4	45.0	53.4
Zone 3	4.5	41.5	44.2
Zone 4	6.0	31.9	35.5
Zone 5	4.0	40.3	49.9
Zone 7	4.2	41.5	61.5
All Zones	4.6	39.3	51.0

In Table 19, acres utilised per milch cow is compared to average production of butterfat per acre for each zone. Both the corrected butterfat per acre and uncorrected are shown. The uncorrected is useful for comparative purposes with previous years. The average of all zones is 51.0 lb. as compared to 51.3 lb. in the previous year, but there is much greater variation between zones than in the previous year.

Considering corrected butterfat per acre production, the only thing which stands out in this table is the position in Zone 4. Here we have a large area (6.0 acres) utilised per milch cow and this is accompanied by a marked per acre reduction in yield. This illustrates that these herds, on the average, appear to be definitely understocked, so far as cows in milk are concerned.

TABLE 19
AVERAGE PRODUCTION OF BUTTERFAT PER ACRE COMPARED WITH THAT OF
THE LEADING HERD IN THIS RESPECT (CORRECTED FOR CONCENTRATES
PURCHASED).

Zone.	Average Acres used for Dairying.	Average Number of Cows per Farm.	Butterfat Production per Acre.	Acres Utilised per Milch Cow.
1. Coastal	259.0	56.0	36.8	4.6
Webb, E. M.	40.0	20.0	79.6	...
2. Bunbury-Donnybrook	154.0	35.0	45.0	4.4
Benson, R. C.	90.0	31.0	87.0	...
Palmer, G.	100.0	33.0	87.0	...
3. Busselton-Margaret River	184.0	41.0	41.5	4.5
Blaikie, G.	88.0	33.0	83.7	...
4. Bridgetown	195.0	32.0	31.9	6.0
Brennan, M.	92.0	34.0	90.4	...
5. Manjimup-Northcliffe	152.0	38.0	40.3	4.0
Bashford, J.	95.0	36.0	88.0	...
7. South Coastal	111.0	26.0	41.5	4.2
Wilde, W.	63.0	25.0	87.0	...
Average all Zones	174.2	37.7	39.3	4.6

TABLE 20
AMOUNT SPENT ON CONCENTRATES AND PROFIT PER COW.

Average Amount spent on Concentrates per Cow.	No. of Cows.	Average Production.		Return on basis of Whole Milk at 2s. 3 $\frac{1}{2}$ d. per gallon.			Return on basis of Butterfat at 3s. per lb.		
		Milk.	Butterfat.	Total Return per Cow.	Return above £0-£1. level.	Additional Profit.	Total Return per Cow.	Return above £0-£1. level.	Additional Profit.
£0-£1	443	lb. 5,081	lb. 205.5	£ s. d. 58 4 5	£ s. d.	£ s. d.	£ s. d. 30 16 5	£ s. d.	£ s. d.
£1-£5	1,009	5,183	207.5	59 6 9	1 2 4	-0 17 8	31 2 5	0 6 0	-1 14 0
£5-£10	404	5,481	219.3	62 16 0	4 11 7	-2 8 5	32 17 10	2 1 5	-4 18 5
£10-£15	559	6,484	257.4	74 5 9	16 1 4	+4 1 4	38 12 2	7 16 0	-4 4 0
£15-£20	133	6,709	268.0	76 15 4	18 10 11	+1 10 11	40 2 0	9 5 7	-7 14 5
£20-£25	91	7,967	311.8	91 2 9	32 18 4	+10 18 4	46 15 5	15 19 0	-6 1 0

AMOUNT SPENT ON CONCENTRATES AND PRODUCTION PER COW

In an endeavour to determine in what circumstances and to what extent the feeding of purchased concentrates is economical, an analysis was made of the return of butterfat and milk per cow according to the amount spent on concentrates. The return of milk per cow had to be estimated on the basis of 4 per cent. of butterfat for all but the herds supplying whole milk.

The average price of butterfat for the 12 months was taken at 3s. per lb. and of whole milk as 2s. 3½d. per gallon. It was considered that the latter price for whole milk took into account both milk supplied within the quota and an average surplus for which a lower return is received.

Table 20 sets out the relevant information. It will be seen that each additional amount spent on concentrates resulted in an increased production both of milk and butterfat.

The productions of milk and butterfat have been translated into monetary return in the next column at the prices mentioned above.

It is shown that for whole milk production the additional return obtained by feeding at various levels of concentrates is barely economical. However, it appears that there is an additional margin of profit at high levels of concentrate feeding compared to low levels or no concentrates. When the additional necessity for maintaining production through the summer months is considered it appears that feeding of concentrates at high levels is economical for whole milk production.

When production is as butterfat it appears that feeding of concentrates is not profitable. At all levels of concentrate feeding above the minimum level the profit is lower than when feeding is at the minimum level. In general the higher the level of feeding of purchased concentrates the less the profit to the producer of milk for butterfat.

This table once again emphasises the importance of the home grown foodstuffs to the dairy farmer. With adequate conservation of fodders the necessity for purchasing expensive concentrates becomes very much reduced and the profit to the farmer considerably increased.

Breed of Bulls in Herds.

The Breeds of Bulls in use in the herds are given in Table 21. It will be noticed that over all zones A.I.S. have the greater numbers and this is brought about by the great predominance of this breed in Zone 1. Guernsey this year had greater numbers than Jersey, but this must be considered to be unusual. Grade bulls showed a further pleasing decline.

There was a total of 89 bulls in use in the 70 herds.

TABLE 21
Breed of Bulls in Herds

Breed	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 7	All Zones
A.I.S.	16	5	4	3	1	1	30
Jersey	1	9	4	5	—	3	22
Guernsey	4	—	5	5	4	9	27
Friesian	4	—	—	—	—	—	4
Red Poll	—	—	—	—	—	1	1
Grade	—	1	—	—	1	3	5
Total	25	15	13	13	6	17	89

Utilisation of Skim Milk.

As in the previous two years this section was worked out on the basis of a scale of points which gave credit to both calves and pigs fed. A maximum of 50 points was allotted in this section where $12\frac{1}{2}$ feeding months per cow were obtained based on the following schedule.

Each porker reared credit three feeding months.

Each calf or baconer reared credit five feeding months.

Each slip reared credit one feeding month.

Each weaner reared credit one feeding month.

For each feeding month below $12\frac{1}{2}$ a deduction of four points was made.

In all zones from 2,639 cows, a total of 1,067 calves were reared and 2,588 pigs. This is 1.46 calves and pigs reared per cow compared to 1.8 in the previous year.

Excluding the whole milk zone the figure is somewhat better at 1.89 calves or pigs reared per cow.

TABLE 22
Utilisation of Skim Milk
Number of Calves and Pigs Fed

Zone.	Cows.	Calves.	Pigs, excluding Sows.	Sows.	Total, Calves and Pigs.	Ratio, Calves and Pigs to Cows.
1	674	140	9	....	149	0.22
2	529	196	801	44	1,041	1.97
3	527	341	323	51	715	1.36
4	322	204	239	23	466	1.45
5	191	50	526	31	607	3.17
7	396	136	690	54	880	2.22
All Zones	2,639	1,067	2,588	203	3,858	1.46
Excluding Whole Milk Producers	1,965	927	2,579	203	3,709	1.89

From table 22 it will be seen that only 1,067 calves were reared from 2,639 cows, this being approximately 40 per cent. of the calves born. This is a decline on the previous year, when approximately 50 per cent. of calves were reared. Of these only 848 were heifer calves, so that heifer calves were reared from only approximately 32 per cent. of the cows which calved. Whilst this is enough for normal replacement, considered at about 25 per cent. per year it leaves little margin for increase of cow numbers and restricts very greatly the culling that can be carried out of low producing animals.

Farmers who do not rear their own replacements should realise that this policy is much sounder than the common one of buying in heifers or cows to keep up the herd strength.

FIG RAISING

Pig raising on a butterfat producing farm can be a very profitable sideline, particularly at the present time when prices for pig meats are so attractive and it is disappointing that more attention is not given in this direction.

Table 23 shows the relationship between the numbers of cows and the number of sows in each zone and, in conjunction with table 22, may be taken as a measure of the activity and interest in pig raising.

The number of sows in Zone 1 has always been very low and in the present competition there were no sows in this zone. The inclusion of this zone has tended to distort the true position of the butterfat producing area and in table 23 two sets of figures are shown, one for all zones and the other exclusive of Zone 1.

Excluding Zone 1, it will be seen that there were 9.7 cows per sow. This is an improvement over each of the two previous years. However, reference to table 22 shows that approximately 1.3 pigs were reared per cow. This is substantially the same as in the previous year and far short of the suggested objective of two baconers marketed per cow milked. This objective can be readily achieved as is shown by the example of such men as B. W. H. Brett, who milked 38 cows and marketed 119 pigs, and Field Bros., who marketed 167 pigs and milked 42 cows.

TABLE 23
Number of Cows per Sow in Zones

Zone.	1950-51.		Number of Cows per Sow.					
	Total Cows.	Total Sows.	1950-51.	1949-50.	1948-49.	1935-36.	1934-35.	1933-34.
1	674	....	....	37.4	60.8	22.8	23.6	34.5
2	529	44	12.0	9.0	11.2	11.7	10.2	10.7
3	527	51	10.3	13.9	9.2	6.2	6.9	15.9
4	322	23	14.0	11.7	12.9	8.6	10.9	11.2
5	191	31	6.2	14.2	48.0	9.7	11.6	10.6
7	396	54	7.3	13.5	11.4	....	8.4	12.3
All Zones	2,639	203	13.0	15.6	17.1	11.2	12.5	14.2
Butterfat Farms only	1,965	203	9.7	11.4	10.3	....	....	....

Breed of Sow.

In Table 24 breed of sow is shown and compared with the breed present in previous years. It would appear from this table that there has been a definite trend in favour of the Large White and its crosses, in particular with the Berkshire. The increase in Large Whites has been chiefly at the expense of the Berkshire-Tamworth cross and possibly of the pure bred Tamworth. Pure bred Berkshires have shown an increase. The desirable weight range for a baconer is from 120-180 lb. chilled dressed weight and unless care is taken in feeding, the carcass has a tendency to exceed this weight by the time the desired conformation has been reached.

TABLE 24.

Breed.	Number.					Per cent.				
	1950-51.	1949-50.	1948-49.	1935-36.	1934-35.	1950-51.	1949-50.	1948-49.	1935-36.	1934-35.
Berkshire	80	65	13	26	26	39.4	38.5	12.9	14	21
Berk. x Tam.	22	30	45	120	75	10.8	17.7	44.5	64	61
Tamworth	16	28	14	....	....	7.9	16.5	13.9	....	....
Large White....	28	21	11	4	9	13.8	12.4	10.9	2	7
L. White x										
Berk.	16	14	....	....	....	7.9				
Large Black	14	4	....	....	....	6.9				
Tam. x Large							14.8	17.8	20	11
Black	6	6	....	....	....	3.0				
Others	21	1	18	38	14	10.3				

Farm Management.

In this section points are allotted for the layout of paddocks on the property and for the convenience and type of building being used for the handling of the herd and produce. Points are also allotted for the keeping of farm records so that the points gained may be taken as a definite indication of the level of management of the property.

There is a definite trend towards better farm layout, no doubt encouraged by the present labour difficulties. Farmers are realising that greater conveniences, which lessen labour requirements are a decided asset. Unfortunately lack of fencing, timber, cement and other building materials have greatly hampered progress in this regard.

The standard of record keeping varies from very good to equally bad. The business of dairy farming is a very complex one and calls for accurate and complete records if efficiency of management is to be maintained. Unfortunately some farmers are still very lax in this regard.

SUMMARY OF DATA

Number of Competitors	70
Average size of herds (cows)	37.7
Average area of pasture per farm	174.2 acres
Average area of pasture per milking cow	4.6 "
Average area per head of stock	2.3 "
Average butterfat production per cow	235.5 lb.
Average yield butterfat per acre	51.0 "
Average yield butterfat per acre corrected for concentrates fed	39.3 "
Fodder conserved per cow—	
Hay	1.26 tons
Silage	0.17 "
Summer crop	0.68 "
Equivalent as hay	1.54 "

Pigs—

Ratio cows to sows

All zones	13.0
Butterfat farms	9.7

Cost of Feeding Pure Bred Dairy Cows

Under the Australian Official Pure Bred Herd Recording Scheme in
Western Australia, 1949-50

H. G. ELLIOTT, Assistant Superintendent of Dairying.

R. A. BETTENAY, Agricultural Adviser.

The present report deals with cost of feeding pure bred dairy cows during the 12 months up to June, 1950, and compares the findings with results of previous years as reported in earlier issues of the Journal.

The first report under this heading was published in 1924, and there has since been a yearly report except for a period of eight years prior to 1948 when no report was published.

The object of the investigation, which is carried out in conjunction with, and as part of, the Pure Bred Herd Recording Scheme, is to determine as nearly as possible the cost of feed to produce both milk and butterfat in pure bred herds, under conditions existing in this State. On the results of such an analysis of feeding costs, combined with information collected from other sources, it is possible to make recommendations as to the most desirable level of feeding and to show an individual farmer where his feeding practice is uneconomical.

The study is not intended to be an investigation of total cost of production and does not take into account any of the items other than feeding which help to make up cost of production, e.g., capital outlay, interest, labour, replacements, income from sale of surplus stock, etc.

The pure bred herds submitted for test are located over a wide area of the South-Western Division, extending from north of Perth to the south coast and inland to the Great Southern railway line. The herds are therefore held under a wide range of climatic conditions and are fed on a wide variety of foodstuffs depending upon availability and price in the particular district. In this study it has not been possible to use the price of foodstuff to the farmer actually landed on the property and the prices used throughout are the average wholesale market prices at Perth.

As in the last two reports, pasture has been standardised at the constant value of 1s. 6d. per week per cow, regardless of quality, as it is believed that over the year the average cost of providing pasture would not exceed this figure. As mentioned in the last report a different valuation was given to pasture in earlier investigations and for comparative purposes with earlier years it would be necessary to deduct in the vicinity of 1d. per gallon of milk or $2\frac{1}{2}$ d. per lb. of butterfat from the pre-war figure.

The investigation is not intended in the form of a competition and, to ensure anonymity the owners' names have been replaced by a letter. Any breeder who desires to obtain the details of his own herd may do so by applying to the Department of Agriculture.

Some minor inaccuracies in the data are to be expected because of the method of collection and because the prices used in computing costs of foodstuffs are average prices of the foodstuffs, but the final result should be comparable between herds in the one year and between years when due allowance is made to the different valuation of pasture in pre-war investigations.

Table I shows the prices of the feeding stuffs which were adopted in the calculation.

TABLE I.

PRICES USED IN EVALUATING THE FOODSTUFFS CONSUMED DURING THE YEAR
ENDED 30TH JUNE, 1950.

	£	s.	d.
Chaff (per ton)	12	5	0
Wheat Crushed (per bushel)	8	6	
Oats Crushed (per bushel)	6	6	
Bran (per ton)	11	10	0
Pollard (per ton)	11	10	0
Branato (per ton)	13	10	0
Pollato (per ton)	13	10	0
Calf Meal (per ton)	22	0	0
Sweet Dairy Meal (per ton)	15	5	0
Dairy Food (per ton)	15	10	0
Linseed Meal (per ton)	18	0	0
Meat Meal (per ton)	17	0	0
Meggitt's Meal (per ton)	18	0	0
Hay (per ton)	7	10	0
Silage (per ton)	1	0	0
Green Feed (per ton)	1	0	0
Lick (per ton)	18	0	0
Bone Meal (per ton)	20	0	0
Molasses (per 44 gallons)	3	0	0
Salt (per cwt.)	5	0	
Pea Meal (per cwt.)	15	0	
Oat Husks (per ton)	5	10	0
Barley (Crushed, per bushel)	6	3	
Pasture (per head, per week)	1	6	

The price of many foodstuffs was higher than the average price for the same foodstuff in the previous 12 months, but in most cases the rise was not great and many remained at the same price over the two years.

The average yearly results obtained since the commencement of the investigation are set out in Table II.

TABLE II.

PURE BRED COWS UNDER OFFICIAL TEST.—AVERAGE RESULTS OVER A PERIOD OF 19 YEARS.

Year ended 30th June.	Average Milk Yield per Cow (gal.).	Average Butterfat per Cow (lb.).	Average Cost of Feed per Cow.	Average Cost of Feed to Produce 1 lb. of Butterfat.	Average Cost of Feed to Produce 1 gallon of Milk.	Average Price of Butterfat per lb., Choice Grade.
			£ s. d.	pence.	pence.	pence.
1924	600	319.50	10 4 10	7.70	4.09	19.5
1925	652	308.59	14 13 2	10.77	6.15	17.5
1926	624	312.01	14 14 7	11.15	5.66	19.0
1927	602	290.72	14 10 5	12.00	5.79	19.0
1928	592	280.56	15 11 4	13.34	6.34	19.5
1929	629	295.10	15 1 0	12.24	5.57	20.0
1930	636	294.98	14 10 3	12.74	5.10	19.5
1931	643	301.60	9 14 7	7.74	3.64	16.0
1932	696	318.96	10 18 3	8.21	3.76	14.0
1933	664	308.60	9 2 3	7.08	3.29	11.0
1934	720	333.70	10 2 6	7.28	3.37	10.0
1935	682	326.61	9 18 0	7.34	3.49	12.5
1936	681	320.14	8 14 7	6.54	3.08	12.5
1937	685	309.31	11 5 1	8.73	3.94	14.5
1938	664	306.99	10 19 7	8.58	3.97	15.0
1939	681	310.13	10 13 7	8.26	3.76	16.0
1948	653	311.20	14 0 6	10.81	5.15	27.0
1949	655	311.17	16 16 2	13.11	6.17	31.0
1950	658	295.83	16 13 4	13.52	6.08	33.0

It will be seen that milk yield has remained very constant over the last two years. Butterfat production however, has shown a decline over that of the previous year. Average cost of feed per cow has decreased very slightly evidently brought about by the feeding of less concentrates than in the previous year. As a result average cost of feed to produce 1lb. of butterfat has risen a little whilst average cost of feed to produce one gallon of milk has actually dropped very slightly.

During the period under review the average price of butterfat has increased by 2d. per lb. This increase has to offset many other increased costs in addition to the greater cost of feeding the cows and should not be taken as suggesting a greater margin of profit to the dairy farmer.

As in previous years, a comparison of efficiency of breeds as producers of both milk and butterfat, has been made. Results for the three breeds tested in the year 1949-50 are set out in Table III.

TABLE III.

BREEDS COMPARED AS PRODUCERS OF MILK AND BUTTER FAT.

Breed.	Average Milk per Cow During Nine Months.	Average Test.	Average Butterfat per Cow During Nine Months.	Average Cost of Feed per Cow	Average Cost of Feed to Produce 1 gallon of Milk.	Average Cost of Feed to Produce 1lb. of Butterfat.
A.I.S.— 7 Herds	7,002	3.78	264.7	£ s. d. 16 10 4	pence. 5.66	pence. 14.96
Guernsey— 9 Herds	6,546	4.67	305.6	16 19 0	6.76	13.31
Jersey— 16 Herds	5,945	5.31	315.7	15 14 3	6.34	11.94

It will be seen than in the present year the A.I.S. breed was the cheapest as a source of supply of whole milk, whilst the Jersey produced the cheapest butterfat; Guernseys occupied an intermediate position in both cases.

Regarding butterfat production the same relative position has been occupied by the three breeds for many years, whilst for milk production the A.I.S. has occasionally been supplanted by the Guernsey as the cheapest source.

In considering the relative suitability of breeds of dairy cattle, however, other factors have to be taken into account in addition to returns as milk or butterfat for a given quantity of feed and it should also be remembered that there are high producing strains within each breed. Accordingly no attempt is made here to recommend any breed and the figures should be considered in conjunction with other advantages and disadvantages of the various breeds.

The relative cost of producing milk or butterfat in the heavy rainfall or recognised dairying districts, compared to the lighter rainfall areas further inland, is shown in Table IV.

TABLE IV.

COST IN LIGHT RAINFALL AREAS COMPARED WITH THE SOUTH WEST.

	Average Production per Cow.		Cost of Feed for :	
	Milk lb.	Butterfat lb.	One gallon of Milk.	One lb. of Butterfat.
Dry Areas— (8 Herds)	7,002	284.5	6.66	16.40
Wet Areas— (24 Herds)	6,327	302.6	5.69	11.91

In the year under review the cost of feeding was considerably greater in the drier areas and this has been the general finding over the years. However, in interpreting these results it should be kept in mind that the cost of feedstuffs used in these calculations was the wholesale market price at Perth and that many of the cows in the dry areas would have been fed on locally grown foodstuffs produced at much less than the ruling price in Perth.

In Table V the herds are placed in order of merit as profitable producers of butterfat. Average cost of feed to produce 1lb. of butterfat was 13.52d. compared with 13.11d. in 1948-49, and 10.81d. in 1947-48. More interesting and significant than the average cost however, is the extremely wide variation which occurs, herds ranging from as low as 3.93d. per lb. to the high figure of 25.62d. per lb. Variation in the previous year was even greater.

It is considered that profit per cow is a better measure of the economics of butterfat production and accordingly some of the information in Table V is re-arranged in Table V (a). Herds are placed in ascending order according to cost of feed per cow and the corresponding profit per cow over and above cost of feed is shown in the next column.

It will be seen that, on the average, herds with below average cost of feed per cow have the greatest average profit per cow. The optimum level of feeding depends upon the potential producing ability of the herd. No amount of feed will cause cows to produce at above their inherited potential and for each additional lb. of food given above a maintenance ration, the margin over previous production is less. Dependent upon these two factors a level is reached when the cost of the additional feed is barely offset by increased production and feeding at above this level is uneconomically high if the only return is from butterfat; if consideration has to be given to obtaining high records to enable the surplus progeny to sell at high prices additional feeding may be warranted. It is considered that the aim of every farmer should be to feed at the level where any additional feed does not give an equivalent monetary return.

This should not be taken to indicate that high levels of feeding are not profitable, but rather to emphasise the advantage of the home grown foodstuff. Fodder reserves cut from the property as hay or silage, green crops, and pasture are the cheapest sources of foodstuff and should be utilised to the fullest possible extent.

Table VI is in an identical form to Table V, but refers to production of whole milk. Average profit per cow under whole milk production was £49 12s. 3d., compared to £27 7s. 10d. as a producer of butterfat. Obviously the increased return from whole milk warrants the feeding of much greater amounts of concentrates. The breed order is not materially altered dependent upon whether milk or butterfat production is required and some herds of each breed produce milk very cheaply. The wide variation in costs of production shown in Tables V and VI further emphasises that for efficient production, breed is not as important as strain within the breed, and herd management. Given good management and a sound breeding and culling programme, any of the three breeds can be brought to an efficient productive level.

TABLE V.
HERDS IN ORDER OF MERIT AS PROFITABLE BUTTERFAT PRODUCERS.

Place.	Herd.	District Wet or Dry.	Breed.	Average Butterfat per Cow for Nine Months.	Available Skim Milk per Cow.	Value of Butterfat at 2s. 9d. per lb.	Value of Skim Milk at 2d. per gallon.	Gross Return from Butterfat and Skim Milk.	Cost of Feed per Cow for Nine Months.	Profit per Cow.	Cost of Feed to Produce 1lb. of Butter- fat.
1	BB	Wet	Jersey ...	285.94	3,055	£ s. d. 36 11 6	£ s. d. 2 10 10	£ s. d. 35 2 4	£ s. d. 4 7 4	£ s. d. 34 14 11	d. 3.93
2	BI	Wet	Guernsey	313.11	3,720	43 9 0	3 2 8	36 11 1	6 11 3	39 10 9	5.07
3	AI	Wet	A.I.S. ...	275.49	4,367	37 19 6	2 2 8	42 1 8	9 1 10	32 10 10	5.45
4	BJ	Wet	Guernsey	318.15	3,389	52 14 6	2 17 4	46 11 0	7 18 9	38 13 0	5.98
5	R	Wet	Guernsey	407.13	3,743	52 19 3	3 16 2	60 6 7	20 18 9	39 17 10	6.32
6	AC	Wet	A.I.S. ...	278.23	5,755	38 18 6	3 16 2	42 2 8	7 15 7	34 7 1	6.71
7	E	Wet	Jersey	403.16	2,927	68 18 0	4 18 10	68 14 10	14 2 6	54 12 4	7.13
8	H	Wet	Jersey	297.19	2,921	34 18 6	2 7 0	37 7 6	8 5 9	28 19 9	7.85
9	X	Wet	Guernsey	257.29	4,256	33 19 3	2 8 8	36 7 1	8 7 3	27 19 10	8.14
10	X	Dry	A.I.S. ...	237.60	2,926	32 14 6	3 15 6	36 10 10	12 7 6	24 2 6	8.78
11	AB	Wet	Jersey	281.63	2,965	36 0 6	2 9 4	38 9 10	9 17 3	28 12 7	9.04
12	V	Wet	Jersey	186.84	1,689	25 14 3	1 8 0	27 2 3	7 6 3	19 16 0	9.38
13	V	Wet	Jersey	275.31	3,242	37 16 3	2 14 0	40 10 3	11 14 9	38 15 6	10.24
14	U	Wet	Guernsey	367.29	4,279	50 9 3	3 13 8	54 3 1	15 14 3	38 8 10	10.28
15	S	Wet	Jersey	311.13	3,995	42 15 3	3 6 6	46 1 9	13 10 9	32 11 0	10.44
16	M	Wet	Guernsey	415.72	5,097	57 4 0	4 10 0	61 8 10	33 9 9	35 2 11	10.58
17	BE	Wet	Jersey	347.13	3,555	47 14 3	2 19 2	50 13 5	15 10 6	32 11 0	11.73
18	BF	Wet	Jersey	360.63	3,509	49 12 9	2 18 4	52 11 3	17 11 9	34 19 6	11.72
19	AN	Wet	Jersey	392.04	3,388	41 10 6	3 10 6	44 6 10	15 3 9	29 3 1	12.08
20	AF	Wet	Jersey	346.86	4,238	47 14 3	3 10 6	51 4 9	20 2 0	31 2 9	13.90
21	BC	Wet	Guernsey	277.11	2,623	38 1 9	3 4 0	41 5 9	16 16 0	24 9 9	14.55
22	BC	Wet	Jersey	250.56	3,055	34 10 3	2 10 10	37 1 1	15 6 9	21 1 5	14.66
23	AE	Wet	Guernsey	246.24	2,894	33 16 6	2 8 2	36 4 8	16 3 3	20 1 5	15.78
24	O	Dry	Jersey	411.47	4,465	56 13 0	3 18 2	60 11 2	27 8 3	33 2 11	16.00
25	F	Dry	A.I.S. ...	290.79	4,692	40 0 3	4 11 8	60 14 10	21 15 0	21 19 7	17.94
26	N	Dry	Guernsey	410.41	5,502	56 7 6	3 14 4	60 14 10	30 11 3	30 3 7	18.31
27	L	Dry	Jersey	360.00	3,679	49 10 0	3 1 2	52 11 2	29 17 0	22 14 2	19.90
28	G	Dry	Jersey	483.12	5,721	66 8 3	4 15 4	71 3 7	40 13 9	30 9 5	20.22
29	AD	Wet	A.I.S. ...	341.28	5,583	46 17 9	4 13 0	51 10 9	31 3 3	20 7 6	21.89
30	AK	Dry	A.I.S. ...	279.18	3,882	38 7 3	3 4 8	41 11 11	26 14 0	14 17 11	22.98
31	Z	Dry	A.I.S. ...	268.83	3,720	36 19 9	3 2 0	40 1 9	27 15 7	12 6 5	24.74
32	AR	Dry	Jersey	415.71	4,635	57 9 6	3 17 2	61 6 8	44 7 3	16 19 5	25.62
	Average			295.83	4,024	40 13 6	3 7 8	44 1 2	16 13 4	27 7 10	13.52

TABLE V(a).

COST PER COW AND PROFIT PER COW UNDER BUTTERFAT PRODUCTION.

Herd.	Cost of Feed per Cow.	Profit per Cow.	Average Profit per Cow.	Per cent. showing Profit per Cow greater than £30.
	£ s. d.	£ s. d.	£ s. d.	%
BB	4 7 4	34 14 11	32 3 9	62½
BI	6 11 3	39 19 9		
Q	7 6 3	19 16 0		
AC	7 15 7	34 7 1		
BJ	7 18 0	38 13 0		
H	8 5 9	28 19 9		
K	8 7 3	27 19 10	33 1 9	50
A.I.	9 1 10	32 19 10		
AB	9 17 3	28 12 7		
V	11 14 9	38 15 6		
X	12 7 6	24 2 6		
S	13 10 9	32 11 0		
E	14 2 6	54 12 4	28 4 8	50
AN	15 3 9	29 3 1		
BC	15 6 9	21 14 1		
BE	15 10 6	35 2 11		
U	15 14 3	38 8 10		
AE	16 3 3	20 1 5		
BG	16 16 0	24 9 9	24 5 3	37½
BF	17 11 9	34 19 6		
AF	20 2 0	31 2 9		
R	20 8 9	39 17 10		
F	21 15 0	21 19 7		
AK	26 14 0	14 17 11		
C	27 8 3	33 2 11	24 5 3	37½
Z	27 15 7	12 6 2		
L	29 17 0	22 14 2		
N	30 11 3	30 3 7		
AD	31 3 3	20 7 6		
M	33 9 9	27 19 1		
G	40 13 9	30 9 5	16 19 5	
AR	44 7 3	16 19 5		

TABLE VI.

HERDS IN ORDER OF MERIT AS PROFITABLE MILK PRODUCERS.

Place.	Herd.	Breed.	Average Milk per Cow for Nine Months.	Value of Whole Milk at 2s. per Gallon.	Cost of Feed per Cow for Nine Months.	Profit per Cow.	Cost of Feed to Produce 1 Gallon of Milk.
			lb.	£ s. d.	£ s. d.	£ s. d.	d.
1	BB	Jersey	5,328	53 6 0	4 7 4	48 18 8	1·96
2	BI	Guernsey	6,066	60 14 0	6 11 3	54 2 9	2·59
3	AC	A.I.S.	7,110	71 2 0	7 15 7	63 6 5	2·62
4	AI	A.I.S.	7,452	74 10 0	9 1 10	65 8 2	2·92
5	BJ	Guernsey	5,706	57 2 0	7 18 0	49 4 0	3·32
6	K	Guernsey	5,184	51 16 0	8 7 3	43 8 9	3·87
7	H	Jersey	5,067	50 14 0	8 5 9	42 8 3	3·92
8	E	Jersey	8,307	83 2 0	14 2 6	68 19 6	4·07
9	X	A.I.S.	6,975	69 16 0	12 7 6	57 8 6	4·25
10	AB	Jersey	5,238	52 8 0	9 17 3	42 10 9	4·51
11	Q	Jersey	3,798	38 0 0	7 6 3	30 13 9	4·63
12	V	Jersey	5,535	35 8 0	11 14 9	23 13 3	5·08
13	S	Jersey	6,372	63 14 0	13 10 9	50 3 3	5·10
14	U	Guernsey	6,687	66 18 0	15 14 3	51 3 9	5·63
15	BE	Jersey	5,994	59 18 0	15 10 6	44 7 6	6·22
16	R	Guernsey	7,758	77 12 0	20 8 9	57 3 3	6·32
17	AN	Jersey	5,697	57 0 0	15 3 9	41 16 3	6·39
18	BG	Guernsey	5,958	59 12 0	16 16 0	42 16 0	6·76
19	BC	Jersey	5,328	53 6 0	15 6 9	37 19 3	6·90
20	BF	Jersey	5,832	58 6 0	17 11 9	40 14 3	7·24
21	AF	Jersey	6,642	66 8 0	20 2 0	46 6 0	7·26
22	AE	Guernsey	5,148	51 10 0	16 3 3	34 6 9	7·53
23	F	A.I.S.	6,894	68 18 0	21 15 0	47 3 0	7·57
24	AK	A.I.S.	8,046	80 10 0	26 14 0	53 16 0	7·96
25	N	Guernsey	8,046	80 10 0	30 11 3	49 18 9	9·11
26	AD	A.I.S.	8,136	81 8 0	31 3 3	50 4 9	9·18
27	C	Jersey	7,146	71 10 0	27 8 3	44 1 9	9·20
28	M	Guernsey	7,596	76 0 0	33 9 9	42 10 3	10·57
29	Z	A.I.S.	6,066	60 14 0	27 15 7	32 18 5	10·98
30	G	Jersey	8,289	82 18 0	40 13 9	42 2 3	11·77
31	L	Jersey	6,021	60 4 0	29 17 0	30 7 0	11·90
32	AR	Jersey	7,083	70 16 0	44 7 3	26 8 9	15·03
Average	....	....	6,578	65 15 7	16 13 4	49 12 3	6·08

The publication of this analysis of feeding costs and profit per cow is to help breeders in an analysis of their feeding methods and to focus attention on pasture and the home grown fodder as the cheapest and best sources of supply. Only by concentration on these can food costs be kept at the low level so desirable to ensure a satisfactory margin of profit above costs.

Paspalum vaginatum or Sea Shore Paspalum

A SUMMER GROWING GRASS FOR WET SALT AFFECTED AREAS

G. H. BURVILL, Commissioner of Soil Conservation
and

*A. J. T. MARSHALL, Lecturer in Agriculture, Muresk
Agricultural College

During the past five years a summer growing, creeping grass *Paspalum vaginatum* has grown well and spread on a wet, salt affected, eroding area of about three acres adjoining a gully at Avondale Research Station, Beverley. In the 16 to 30-inch rainfall belt there are hundreds of similar wet salty seepage areas, which are unproductive, and which, in addition, are subject to soil erosion and constitute a menace to the adjoining productive soils. If a grass like *Paspalum vaginatum* were established on these areas great benefit would result. To this end about 200 bundles of rooted pieces of the grass have been distributed in the past three years to interested farmers. A later survey of those farmers who were supplied in 1947 showed that a number reported success, but there were many failures because it was impossible to keep stock and rabbits away from the green grass. In a minority of cases the site was too salty or too dry for the grass to succeed.

Paspalum vaginatum came to the notice of the Department of Agriculture through Major C. Bleechmore of Noggerup, who obtained a few runners of the grass in 1936 from Dr. H. C. Trumble of the Waite Agricultural Research Institute, Adelaide. Dr. Trumble in his book "Blades of Grass," describes *Paspalum vaginatum* as "a salt tolerant grass, imported from the west coast of South Africa, where it is frequently inundated without adverse affect, by tidal water from the sea, and utilised at low water as a racecourse." Major Bleechmore established the grass at Noggerup in salt areas where common couch (*Cynodon dactylon*) died, and later supplied roots to Dr. L. J. H. Teakle, who arranged their planting at Chapman Research Station, north of Geraldton. In this situation the plants survived, but apparently the site was too dry in summer for really good results. A small bundle of rooted pieces from Chapman was planted at Avondale in August, 1945. It was protected from stock by fencing and only a few rabbits were present in the vicinity. Protection from animals and ample ground moisture throughout the summer caused a rapid spread (see Fig. 1). Natural spreading, and the planting out of rotted pieces on other areas, including erosion gullies and eroded creek sides, has greatly increased the area under the grass.

* Formerly, Agricultural Adviser, Wheat Branch, stationed at Beverley.



Fig. 1.

One summer's growth, 1945-46, of *Paspalum vaginatum* at Avondale Research Station, Beverley. Note runners up to three feet long. Small rooted pieces were planted in rows three feet apart on a salt affected area with ground water 12 to 18 inches below the surface. The ground water has about 400 grains of salts per gallon.

ALL SALT AFFECTED AREAS ARE NOT SUITABLE FOR PASPALUM VAGINATUM

Excess salt in the soil causes bare patches of greater or lesser size on numerous farms particularly in the wheat belt of the State. They are mostly caused by the redistribution of salt in the soil after the natural vegetation is cleared away for farming. The changes in moisture conditions and moisture movements after clearing bring about salt movements which often result in excessive surface concentrations. But all salt affected areas are not suited to *Paspalum vaginatum*. It requires ample moisture during the summer to make any reasonable growth and it has not done well where the ground water, even though present in abundance at shallow depths, contains too much salt—say more than 1,200 grains per gallon of common salt. The successful growth at Avondale is on an area where the ground water is one to two feet from the surface and contains 350 to 400 grains of common salt per gallon. (Total water soluble salts 400-450 grains.)

METHOD OF ESTABLISHMENT

Seed of this grass is not available and rooted pieces must therefore be used to establish new areas. Flower heads, similar in general appearance to those of ordinary couch grass, are produced in abundance during the summer, but so far, no seed has been found in these flower heads. The reasons for this are to be further investigated. Rooted

pieces, planted in moist or wet soil in late August or early September, and spaced at intervals of one or two yards, give a good establishment if there is ample summer moisture from seepage and if stock and rabbits can be kept away. Surface runners, which root at intervals, may grow four feet in the first summer. The grass usually begins new growth in late August after its winter dormancy. This has proved a convenient time to distribute roots to farmers because consignments are able to reach their destination without becoming too dry. Once a small area is established on any property, however, it is probable that planting out of rooted pieces into suitable moist or wet places could be done at any convenient time, even in summer.

GROWS IN WATERLOGGED AND MOIST ERODED AREAS

Paspalum vaginatum will tolerate waterlogged conditions and periodic flooding. Some of the most vigorous growth at Avondale is where the grass has moved in from the gully sides and now covers the creek bed where it traps soil moving downstream after heavy rains. Wet boggy places are suitable points for establishment because stock cannot reach the grass till it has become well established and spread.



Fig. 2.

Eroded area adjoining a gully caused primarily by seepage and salt concentration.
Paspalum vaginatum will grow in such seepage areas.

(Photo.: W.A. Govt. Printer.)

The growth of this grass in eroded salt affected areas is most encouraging. Even in tough clay sub-soil exposed by erosion it grows quite well provided the moisture is adequate in summer. It would probably be a good lawn grass where only brackish water is available for watering.

SUMMER GRAZING

Paspalum vaginatum is quite palatable to stock and can provide valuable green picking in summer. Stock and rabbits are a serious handicap in establishment where the area cannot be fenced off. But once established, the experience at Avondale has been that grazing only delays the spread of the grass—it is not then readily eaten out.

DISTRIBUTION OF ROOTS

Farmers interested in trying this grass should inquire among local farmers to secure a few rooted pieces. If none is available a request should be sent before mid July to the Commissioner of Soil Conservation, Department of Agriculture, Perth, who arranges the distribution of small bundles in co-operation with the Superintendent of Wheat Farming.

Hypocalcaemia (Milk Fever, Grass Tetany) in Breeding Ewes

C. R. TOOP, Chief Veterinary Surgeon.

Following upon the early April rains which resulted in a rapid abundant growth of green feed in many districts, widespread outbreaks of hypocalcaemia have been reported amongst breeding ewes. Although sporadic outbreaks have been reported in the past the disease does not appear to have previously assumed serious proportions and its prevalence this year must be attributed to the unusually favourable seasonal conditions which have coincided with lambing.

Hypocalcaemia results from a lowering of the calcium content of the blood and in this respect the disease in sheep resembles the condition of milk fever which affects dairy cows about the time of calving. Pregnant and lactating ewes are most commonly affected, especially when grazing on lush pastures or on young cereal crops. Under such conditions driving even for a short distance or a brief period of starvation resulting from yarding may precipitate an attack of the disease.

Hypocalcaemia is not, however, confined to lambing ewes but may also affect dry ewes as well as rams, wethers and young sheep. The outbreaks which occur amongst dry sheep are usually associated with a sudden check to feeding such as may result from shearing, crutching or dipping, or transport by road or rail. The grazing by hungry sheep of plants rich in oxalates such as sorrel or soursobs may also produce the disease.

The onset of the disease is sudden and the symptoms consist of dullness, unsteadiness of gait, muscular tremors and coma, followed by death within a few hours up to 2-3 days.

For the treatment of the disease the injection of a solution of calcium borogluconate for the purpose of restoring the blood calcium to its normal level is recommended and this in the majority of cases is followed by a rapid and often quite spectacular recovery.

The prevention of the disease is largely a matter of management and in seasons which favour its occurrence care should be exercised with the handling of in-lamb and milking ewes so as to avoid unnecessary driving or yarding for unduly long periods.

CAUSE.

As the name hypocalcaemia denotes the disease is associated with a reduction of the calcium content of the blood, which in severe cases may fall considerably less than half the normal level. It may occur under a wide range of conditions but in breeding ewes it is most likely to make its appearance in seasons where there is an early and luxuriant growth of green feed. In pregnant and lactating ewes, grazing on lush pastures or on young wheat or oat crops favours the development of the disease and the risk is increased by droving or yarding. Even driving for a short distance such as from the paddocks to the yards may precipitate an attack. So also may a brief period of starvation resulting from yarding overnight or even for a few hours, particularly if the ewes are driven when released from the yards.

Amongst other factors which may predispose to the disease may be mentioned:—(a) The turning of hungry sheep on to green feed after train journeys. (b) The grazing by hungry sheep of pastures in which plants rich in oxalates such as sorrel, soursobs, or roly poly are abundant. Oxalates reduce the calcium content of the blood. (c) A sudden check to feeding such as may result from shearing, crutching or trucking particularly if this is followed by droving. (d) Heavy feeding on cereal grains or cereal chaff which are low in calcium. Sheep fed on these products do not develop hypocalcaemia unless deprived of roughage in the form of dry grazing, clover burr or scrub which contain adequate amounts of calcium and do not develop symptoms unless driven.

In Western Australia, hypocalcaemia in dry sheep appears to be of infrequent occurrence. A serious outbreak, however, was recently reported in a consignment of weaners which had been railed to a remote district after purchase at Midland Junction and released on to green feed.

SYMPTOMS.

The disease occurs principally amongst in-lamb and milking ewes which may become affected from six weeks prior to lambing up to about 10 weeks afterwards. Its onset is sudden and a considerable number of animals may show symptoms at the same time. The early symptoms consist of staggering or unsteadiness of gait with a stiff or stilted action usually affecting the hind legs but sometimes all four legs. Affected sheep are dull and listless and disinclined to move. When driven they show symptoms of trembling and shivering while in motion. There is usually a watery discharge



A case of hypocalcaemia.

(After H. T. Carroll.)

from the nostrils and some cases may show evidence of scouring. Soon the animal goes down and is unable to rise and sinks into a condition of coma. A characteristic posture has been described in which the animal lies on the brisket with the hind legs straddled out behind and with the neck extended and the lower jaw resting on the ground, but this has not been observed in the cases coming under our notice. Without appropriate treatment death may occur within a few hours but some cases may linger for two to three days.

POST MORTEM APPEARANCES.

At post mortem nothing of diagnostic significance will be observed. The third stomach or "Bible" is usually hard and contracted and the caecum or blind gut may be distended with gas and thereby considerably enlarged. The liver and kidneys are congested and there may be large haemorrhages on the external surface of the heart.

DIAGNOSIS.

From a consideration of the history of the outbreak, the class of animal affected and the symptoms exhibited the diagnosis of hypocalcaemia should in most cases present no serious difficulty. In the case of ewes advanced in pregnancy it might possibly be confused with pregnancy toxæmia. The symptoms of stupor and partial or complete blindness which occur in pregnancy toxæmia are, however, distinctive and the animal lingers from several days to a week before death occurs. In addition, the liver in pregnancy toxæmia is infiltrated with fat being characteristically pale yellow in colour and very soft, whereas in hypocalcaemia it shows little abnormality. Finally, pregnancy toxæmia is most likely to occur during adverse seasons when the ewes are losing condition, whereas in hypocalcaemia the reverse usually obtains.

Should any doubt exist in the matter a sample of blood comprising about four ounces should be obtained from an affected animal and forwarded to the Animal Health and Nutrition Laboratory for calcium determination.

As a practical means of diagnosis an affected sheep may be injected with the prescribed dose of calcium borogluconate and should prompt recovery occur this will leave no doubt regarding the condition with which the animal is affected.

TREATMENT.

For the treatment of affected animals the injection of a solution of calcium borogluconate is recommended. When administered in the prescribed dosage this will increase the calcium content of the blood to the normal level, resulting in rapid recovery. Calcium borogluconate is available in packets containing $2\frac{1}{2}$ ounces which is sufficient for the treatment of five sheep. The contents of the packet are dissolved in 10 ounces of boiling water and the solution is allowed to cool before use. The dosage for the sheep is 60 c.cs. (two ounces) and this should be injected either into the jugular vein or beneath the skin using a large hypodermic syringe.

Alternatively a solution of calcium borogluconate may be prepared in accordance with the following formula:—

Calcium gluconate	....	....	8 ounces.
Boric acid	....	....	2 ounces.
Water	....	....	2 pints.

Upon boiling these ingredients together a clear solution will be produced. This should be allowed to cool and injected in a dosage of 60 c.c. If it is desired to store the solution a few drops of Thymol should be added to prevent the growth of moulds.

Following the administration of calcium borogluconate in the dosage prescribed above, complete recovery will usually occur within a few minutes to half an hour or a little longer. Should no response have occurred after an hour the injection should be repeated.

In the case of wet ewes a satisfactory response may be obtained by the inflation of the udder with air in the manner employed for the treatment of dairy cows suffering from milk fever. In an emergency a bicycle pump may be used inserting the valve from which the rubber has been removed into the teat duct and inflating each of the quarters firmly but not over-tightly with the air. The valve should be sterilised by boiling before use and after inflation the end of the teat should be pinched to prevent the escape of air. When a milk fever outfit of the type supplied for the treatment of cattle is employed, the large teat tube or siphon which might damage the teat duct of the ewe should be substituted by a hypodermic needle with the point removed and rounded off by filing.

When supplies of calcium borogluconate are unavailable drenching with molasses in a dosage of half a pint mixed with an equal volume of water may be practised. Molasses contains readily available calcium salts and may be effective in the treatment of early cases. It should not, however, be regarded as a substitute for calcium borogluconate.

PREVENTION.

Since the disease is likely to make its appearance amongst breeding ewes in early seasons when green feed is plentiful on all parts of a property during or just prior to lambing the adoption of preventive measures will in many instances prove difficult. Under these conditions, roughage in the form of hay should be distributed to the ewes in the paddocks or where a haystack is available in the paddock the flock should be allowed free access to it. Since driving or deprivation of food for even a short period may predispose to the disease in lambing ewes the flock should as far as possible be left undisturbed.

Where yarding cannot be avoided, the flock should be driven slowly and quietly and retained in the yards for as short a period as possible. Yarding overnight should at all costs be avoided. Droving after yarding should whenever possible also be avoided.

The grazing of young wheat or oat crops should at first be restricted to a short period daily and the ewes should be fed roughage before being turned on to the paddock. Later as the crop is eaten back and the animals become accustomed to the change of diet the period of grazing may be lengthened.

When an outbreak has actually occurred a change to poorer pasture in another paddock will usually prevent further losses.

In the case of ewes fed heavily on cereal grains in the absence of suitable roughage a lick composed of two parts of ground limestone and one part of salt should be provided.

Hungry sheep should not be allowed access to plants with a high oxalate content.

Soil Salinity Investigations

SALT TOLERANCE, GERMINATION AND GROWTH TESTS UNDER CONTROLLED SALINITY CONDITIONS

A. J. MILLINGTON*

G. H. BURVILL†

B. a'B. MARSH‡

NOTE.—In April, 1949, the Shackleton-Kwolyin Branch of the Farmers' Union suggested to the Trustees of the W.A. Wheat Pool that consideration be given to financial support for investigations on the wheat belt salt problem. The Trustees consulted Professor E. J. Underwood, Director of the University Institute of Agriculture, and Mr. G. H. Burvill, Commissioner of Soil Conservation, and on their recommendation agreed to give effect to the above suggestion by making money available for several years to assist a research programme at the Institute. The project is being conducted jointly by the Institute of Agriculture and the Department of Agriculture. Both organisations are grateful for the interest shown in this problem by the Trustees of the Wheat Pool and the members of the Farmers' Union. The trials reported hereunder were largely exploratory and the results are being published to indicate the directions in which the research is proceeding.

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Acting Director of Agriculture.

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INTRODUCTION

The salt problem in the W.A. wheat belt is well known and widespread though it does not often affect a large proportion of the land on single farms. The problem extends into the wetter country west of the wheat belt up to annual rainfalls of about 30 inches, and occasionally affected areas are found in the high rainfall areas of the south-west. It is causing increasing concern, especially in some outer wheat belt parts where broad flats are becoming waterlogged with salt water.

In approaching the problem it must be recognised that salt can concentrate in the surface soil and affect plant growth under different sets of conditions. But in all cases the salt movements in the soil depend on moisture movements. It should be noted, also, that salt affects plant growth mainly because it restricts moisture supply and plants vary in their ability to obtain water when salt is dissolved in the soil moisture. For reclaiming saline areas plants must therefore possess capacity to germinate, and capacity to grow, under salty conditions.

THREE MAIN TYPES OF SALT AFFECTED LAND

Three main sets of conditions, which give rise to a salt problem in this State, must be recognised in seeking a solution to the problem and in making recommendations for treatment.

(1) *Summer Moist Areas.*

On the sides of gullies and on hillside slopes in the 16 to 30 inch rainfall areas, springs and seepages commonly develop some years after clearing. Excess subsoil water accumulated from the winter intake of rain is brought to the surface by impervious subsoil layers and the soil remains wet throughout the year. The water may be brackish or quite salty—say, 200 to 1,200 grains per gallon and such “soaks” are often useful for stock water. But evaporation at the soil surface concentrates salts and bare sterile patches result. A few inches below the surface the salt concentration in the soil may be quite low.

For such areas the creeping, summer growing grass, *Paspalum vaginatum* is recommended as it has shown salt tolerance, but requires ample summer moisture for good growth. *Sporobolus virginicus* (“salt water couch”) has also been advocated because of its salt tolerance and summer growth.

(2) *Salting due to Valley Waterlogging.*

This condition is related to (1) above, but larger areas become affected. Where the topography is flatter, as in the outer wheat belt, the relatively broad flat valleys are often affected by a rising ground water level. This has followed agricultural development and seems to be accentuated by wet winters like 1945 and 1946 when flooding was common. Salt water, about the concentration of sea water,

originally occurred at depths of 15 to 30 feet in many places, but is now found in borings within six feet of the surface. From such shallow depths saline water readily reaches the soil surface by capillary action and evaporates, leaving the salt in the surface soil. Bare sterile patches are the result.

Paspalum vaginatum has not succeeded on such areas. Though the soil is moist in summer, the salt concentration in the root zone seems too high for this grass.

Cereals and Wimmera rye grass planted with superphosphate in winter on these areas for green or dry grazing are recommended to maintain or improve their productivity. More or less continuous grazing without cultivation, seed or super. leads to further deterioration of the land and sometimes to soil erosion by wind or water.

(3) Salt Patches Without Shallow Water Tables.

Bare salt patches develop after clearing on some of the heavier soils and the powdery morrel soils of the outer wheat growing areas with 11 to 14 inches annual rainfall. These soils occur on the flats or gentle slopes of the valleys of the salt lake systems, but it is also common to find salt patches on similar soils in the higher parts of the landscape. These soils contain quite large amounts of salt before clearing, and although the ground water level, if any, is 15 feet or more from the surface, yet redistribution of salt occurs in the upper layers and bare patches, often caked and hard, develop due to salt concentration.

Where the bare patches are numerous and cereal cropping for grain is unprofitable, treatment as described under (2) is recommended. *Paspalum vaginatum* is unsuited to such conditions.

SCOPE OF INVESTIGATIONS

The trials here reported were directed to three aspects of plant growth under salt conditions:—

- (a) Tests for salt tolerance of various summer growing grasses, grown in various dilutions of sea water.
- (b) Germination tests in salted soil with the seeds of cereals, grasses and other plants of reputed salt tolerance.
- (c) Growth and salt tolerance tests in artificially salted soil columns using various cereals, annual grasses and plants of reputed salt tolerance.

TESTS FOR SALT TOLERANCE ON SUMMER GROWING GRASSES

Three grasses known to show salt tolerance to some degree were included:—

- (1) *Paspalum vaginatum* or sea shore *Paspalum*.
- (2) *Sporobolus virginicus* or salt water couch.
- (3) *Cynodon dactylon* or common couch grass.

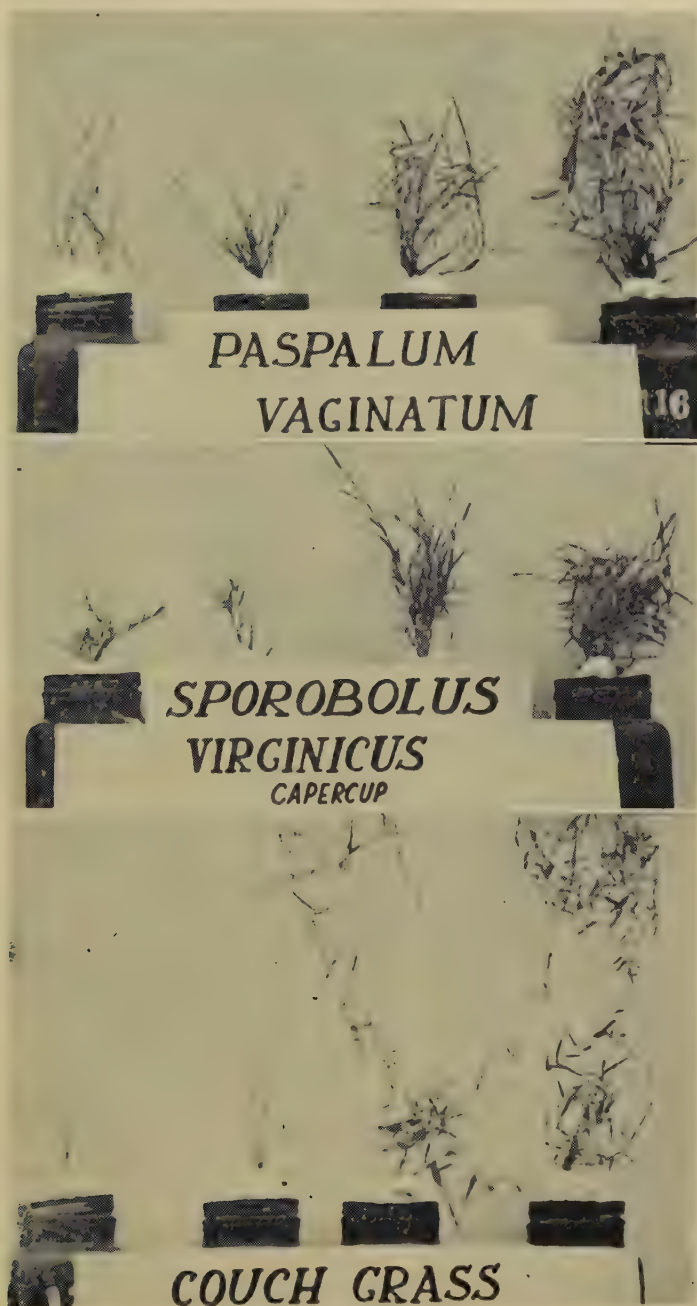


Fig. 1.

Salt tolerance tests of summer growing grasses in various dilutions of sea water. Photographs taken after four months' growth, December to March. The concentrations used in each set of jars were, left to right, (i) $\frac{2}{3}$ sea water, $\frac{1}{3}$ Perth tap water, giving approximately 1,700 grains total salts per gallon; (ii) $\frac{1}{2}$ sea water, $\frac{1}{2}$ tap water, or approximately 1,275 grains per gallon; (iii) $\frac{1}{4}$ sea water, $\frac{3}{4}$ tap water, or approximately 650 grains per gallon; (iv) tap water, approximately 20 grains per gallon.

Rooted material of *Paspalum vaginatum* was obtained from Avondale Research Station where it grows well on summer moist salt land. Four strains of *Sporobolus virginicus*, "salt water couch," were used. One strain of this has been distributed in Western Australia by Mr. B. Chambers, of Capercup, for reclamation purposes. Mr. Chambers co-operated by supplying two types of *Sporobolus* from his Capercup property. Other strains from the Avon River at Muresk Agricultural College, and from the Swan River near Perth, were also included. Some strains at least of this species have the advantage over *Paspalum vaginatum* of setting seed, and for this reason their establishment could be simplified compared with the need to plant cuttings as is necessary with *Paspalum vaginatum*.

Common couch grass (*Cynodon dactylon*) is regarded as showing moderate tolerance of salt. Rooted material was obtained from patches which occur adjacent to creeks at Avondale Research Station.

Rooted pieces of the various grasses were supported by covers with their roots dipping into jars of solutions made up by diluting sea water with Perth tap water and adding essential nutrient salts. Four bottles were set up for each of the grasses or strains at each level of salinity or one hundred and twenty bottles in all. (See Fig. 1). The results of this trial are given in Tables II and III at the end of the article. It was found: (i) that all the *Sporobolus* strains tested and *Paspalum vaginatum* are much more salt tolerant than ordinary couch grass and (ii) that at all the concentrations used the *Paspalum vaginatum* is more productive than the *Sporobolus*. The trial extended over four summer months, December to March.

It is proposed to extend this study of summer growing grasses to include additional strains of *Sporobolus virginicus*. The lack of seed setting by *Paspalum vaginatum* may also be investigated.

GERMINATION TESTS IN SALTED SOIL

To establish plants from seed in attempts to reclaim salt land it is necessary to have species which will germinate under salt conditions. Germination trials were made in a sandy clay loam surface soil from salmon gum and gimlet forest country at the Merredin Research Station.

Cereals.

The soil was salted with common salt to give six levels ranging from natural soil (less than .02 per cent.) to 0.3 per cent. sodium chloride. The soils were wetted to about 10 per cent. soil moisture and kept in covered dishes to prevent drying. The trial contained nine cereal varieties and continued for 19 days. (See fig. 2.) It was found that the greatest capacity to germinate under salty conditions was shown by cereal rye, followed by Wongoondy wheat, then the barley varieties, with oats showing least capacity. (See Table IV.)

Germination is not only restricted under saline conditions, but also considerably delayed. These trials showed that despite the use of a commercial fungicidal dust, protection was inadequate and considerable mould growth developed on the seeds. Apparently the



Fig. 2.

Seed germination tests in soil containing different amounts of salt. Six concentrations were used. Above are shown the results with varieties of wheat, oats, barley and rye after 19 days.

Left—Soil containing 0.3 per cent. sodium chloride; the prominent shoots in the top row are Slav rye; most varieties gave no germination.

Right—Soil containing 0.1 per cent. sodium chloride; germination ranged from 60 to 100 per cent.

various moulds could tolerate the higher levels of salinity and their presence tended to further reduce the capacity of the seeds to germinate. In view of the importance of this aspect under practical farming conditions it is being further investigated.

Pasture Species.

A similar trial with six pasture species using Wongan oats as a control demonstrated the superior capacity of sea barleygrass (*H. maritimum*) and lucerne (*M. sativa*) to germinate under saline conditions. (See Table V.)

These results also were influenced by mould growth but demonstrate the general experience that although species such as trailing salt bush (*A. semibaccata*) can grow under saline conditions they require low levels of salinity for good germination. The level of salinity in the surface soils on bare patches of the heavy soils and powdery morrel soils in the wheat belt is usually greater than 0.2 per cent. (chloride expressed as sodium chloride).

TESTS FOR SALT TOLERANCE AND GROWTH

Under normal conditions in the wheat belt, plants rely on the winter rainfall for their moisture supply. On saline soils rain, by diluting the soil solution, has the effect of reducing the salt concentration to a point where plants may be able to grow. Growth may be achieved therefore by (a) quick growing species which are able to seed down before evaporation increases the salinity of the soil moisture to critical levels, or (b) species which have the capacity to draw moisture from relatively salty soil solutions and are therefore "salt tolerant." The cereals are notable for their capacity to grow rapidly during the winter and to that extent come within the category of "salt escaping" plants. Species such as the saltbushes on the other hand, can tolerate considerable concentrations of salt in the soil moisture and are therefore "salt tolerant."

Cereal Trials.

On saline soils the beneficial effect of cultivating the surface soil to provide a seed bed for either weeds, cereals or fodder species has been stressed by the Department of Agriculture for many years. Moreover, it affords a convenient opportunity to apply superphosphate and to plant the fodders.

To ascertain the relative tolerance of the common cereals trials were conducted in the 1950 winter using soil columns artificially salted with common salt. In these columns the degree of salinity increased with depth to give a profile similar to that of many salt affected soils in the wheat belt. Figure 3 shows the method of preparing these columns and the general arrangement of the columns in a pit during the trial. Each column was prepared in five separate sections each of six inches. The desired level of salinity at each level in the profile was achieved by wetting with a measured amount of water in which the requisite quantity of salt had been dissolved. The total water added to the column was equivalent to about six inches of rainfall and no additional water was applied during the growth of the crop. The experiment was suitably covered to keep out natural rainfall. The soil columns at planting time had the following salt concentrations at each level in the profile:—

0-6in.	.05%	sodium chloride (common salt)
6-12in.	.15%	
12-18in.	.25%	
18-24in.	.35%	
24-30in.	.40%	

Each salted column was paired with a non-salted one brought to the same moisture content, in order that the growth differences caused by the salt could be estimated.



Fig. 3.

Growth tests in salted and non-salted soil.

Top—Preparing soil columns enclosed in tarred paper.

Bottom—General arrangement of cereal trial with columns fitted into a timber lined pit.

Two soils were used, one trial being with sandy clay loam which was typical of the surface soil of the Merredin Research Station and the other with a fine sandy loam from the Swan River alluvium at Guildford. Some of the results are given in Table I and show

that on salty soils in these trials the feed barleys gave the greatest yield of forage with the commercial oat varieties next in order of productivity. Figure 4 shows the comparative growth of the oats and barleys in salted and non-salted columns.



Fig. 4.

Growth of oats and barleys in salted and non-salted soil. The salted column is on the right in each pair. The varieties shown are, left to right:—

Top—Oats: Early Wonder, Wongan, Guyra.

Bottom—Barleys: Greenough, Velvon, Atlas.

TABLE I.
YIELDS OF FORAGE ON SALTED SOILS
(Air dry weights)

Oats—	Variety.		Merredin Soil.	Guildford Soil.
	Early Wonder	....	4.2 cwt./acre	5.1 cwt./acre
	Wongan	....	13.0 " "	20.9 " "
	Guyra	....	16.5 " "	25.4 " "
Barleys—				
	Greenough	....	11.5 " "	30.0 " "
	Atlas	....	16.0 " "	39.0 " "
	Velvon	....	16.0 " "	41.2 " "
Cereal rye—				
	Slav	....	5.3 " "	14.2 " "
Wheat—				
	Wongoondy	....	9.7 " "	5.1 " "
Difference for				
significance (P = .05)		....	3.5 " "	9.5 " "

Besides the yields such as are given in Table I, information on salt tolerance was sought by studying root penetration in the columns. (See fig. 5.) It was expected that salt tolerance would be indicated by the capacity of different species or varieties to send



Fig. 5.
Root top growth made by Won-
gan oats in salted soil (left) and
non-salted soil (right). The soil
was carefully washed away from
the roots, but small roots are
not easily followed. The black
bands on the ruler are at 6-inch
intervals.

their roots into increasingly salty layers for moisture after using available moisture in upper layers. Some information was obtained, though there are complications due to salt movements during the growth period, and the tracing of the penetration of small roots is not easy. Of more importance practically are results as given in Table I.

Pasture Species Trial.

For this trial columns of Guildford soil were prepared as for the cereals but more salt was included to give these concentrations:—

0-3 inches	....	0.1 per cent. sodium chloride (common salt)
3-6 inches	....	.2 per cent.
6-9 inches	....	.3 per cent.
9-12 inches	....	.4 per cent.
12-15 inches	....	.5 per cent.
15-18 inches	....	.6 per cent.

Unsalted columns were used for comparison.

The following species were included in the trial:—

Lucerne (*Medicago sativa*).

Curly rye grass (*Pholiurus incurvis*).

Wimmera rye grass (*Lolium rigidum*).

Sea barley grass (*Hordeum marinum*).

Mangolds (*Beta vulgaris*).

Creeping saltbush (*Atriplex semibaccata*).

Wongan oats (*Avena sativa*).

Seed sown into the moist salted columns gave very poor results because salt concentrated in the surface as the surface dried. Further seed was therefore germinated in the laboratory and the seedlings transplanted and watered several times to overcome this initial handicap.

Comparing the salted and unsalted columns, Wongan oats and lucerne showed poor or indifferent salt tolerance. The other species showed much greater tolerance in the order:—

Creeping saltbush (most tolerance).

Curly rye grass.

Mangolds.

Sea barley grass.

Wimmera rye grass.

With creeping saltbush and curly rye grass the season's growth was greater on the salted than the non-salted soil and both curly rye grass and Wimmera rye grass were a darker green colour on the salted columns. These effects may be related to the nitrogen supply. Soil micro-organisms producing ammonia and nitrate may have been stimulated by the better moisture conditions in the surface layers of the salted columns. The presence of the salt reduces the drying out of the surface. Better growth and darker green colour of cereals and grasses around salt patches have often been noted in the field. There is obvious scope for further study of these phenomena.

DISCUSSION AND CONCLUSIONS

General conclusions derived from the trials so far are that cereal rye has a superior capacity to germinate under saline conditions, but that it has relatively poor tolerance during subsequent growth and development. Of the cereals the feed barleys appear to have the greatest capacity for both germination and winter growth on saline soils. The germination tests suggest that seeding rates higher than for normal soils will increase the chance of a satisfactory stand of plants. Seed for planting affected areas should be not only plump and recently harvested, but it should be treated at the recommended rate with an appropriate fungicidal dust and, if practicable, not sown until the winter rains have lowered the salt concentration of the soil moisture in the surface layers.

The salt tolerance of curly rye grass, sea barley grass and creeping saltbush, compared with oats, is emphasised, but none is easy to establish because of practical difficulties. Wimmera rye grass, though perhaps somewhat less salt tolerant, can be planted more readily as seed supplies are available commercially.

TABLES II AND III—SALT TOLERANCE TESTS IN VARIOUS DILUTIONS OF SEA WATER.

TABLE II.

Number of Deaths in One-half and Two-thirds Sea Water.

Reg. No.	Species.	Origin.	Percentage of dead plants in the two treat- ments.			
N. 282	<i>Paspalum vaginatum</i>	Avondale Res. Stn.	....	....	....	Nil
393	<i>Sporobolus virginicus</i> *	Capercup	....	....	....	10
394	" "	Capercup	....	....	....	10
424	" "	Muresk	....	....	....	Nil
410	" "	Swan River	....	....	....	30
281	<i>Cynodon dactylon</i> †	Avondale	....	....	....	70

* Saltwater couch.

† Common couch.

TABLE III.

Yield of Tops and Roots in grams, air dry.

Average per plant of surviving plants after four months, December-March.

Reg. No.	Species.	Origin.	Salinity Level: Proportion Sea Water.			
			2/3	1/2	1/4	Nil
N. 282	<i>P. vaginatum</i>	Avondale	 3.8	4.6	16.8	27.6
393	<i>S. virginicus</i>	Capercup	 2.2	2.2	1.7	6.8
394	"	Capercup	 1.7	1.8	4.6	9.4
424	"	Muresk	 1.8	1.6	2.8	10.8
410	"	Swan River	 1.3	1.7	2.7	5.4
281	<i>C. dactylon</i>	Avondale	 2.0	2.0	7.6	26.4

TABLES IV AND V—GERMINATION TRIALS ON SALTED
MERREDIN SOIL.

TABLE IV.—CEREALS.

Total germination after 19 days as a percentage of "No Salt."

Salinity Level (Sodium chloride) per cent.	Oats.			Barleys.				Wheat.	Rye.
	Guyra	Ballidu	Wongan	Prior	Atlas	Beecher	Research	Wongoondy	Slav
No salt	100	100	100	100	100	100	100	100	100
.10%	68	62	60	96	92	93	92	77	100
.15%	57	17	8	67	85	60	74	77	100
.20%	4	0	0	8	12	0	15	73	100
.25%	0	0	0	8	4	4	15	77	96
.30%	0	0	0	0	0	4	0	18	80

TABLE V.—PASTURE SPECIES.

Total germination after 28 days as a percentage of "No salt."

Botanical Name	<i>Lolium rigidum</i>	<i>Pholirus incurvus</i>	<i>Hordeum maritimum</i>	<i>Atriplex semi- baccata</i>	<i>Beta vulgaris</i>	<i>Avena sativa</i>	<i>Medicago sativa</i>
Level of Salinity (Sodium chloride) per cent.	Wimmera Rye grass.	"Curly" Rye grass.	"Sea" Barley grass.	Trailing Saltbush.	Mangold.	Wongan Oats.	Lucerne.
No salt	100	100	100	100	100	100	100
.1%	46	75	75	13	30	57	100
.2%	6	0	60	5	0	15	56
.3%	0	0	5	0	0	0	1

FERTILISERS

The following additional fertilisers have been registered at the Department of Agriculture under the Fertilisers Act, 1928, for the year commencing 1st November, 1950.

Name of Fertiliser.	Reg. No.	Brand.	By Whom Registered.	Nitrogen (N) as			Phosphoric Acid (P ₂ O ₅) as				Potash (K ₂ O) as		Cash Price per ton at Works (W) or on Rails Perth (P).	
				Ni- trate.	Am- monia.	Blood and Bone.	Bone Dust.	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sul- phate.		Muri- ate.
A.—MINERAL.														
PHOSPHATIC.														
Christmas Island Phosphate Rock	107	C.S.M.L. ...	Cuning Smith & Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	36.6	36.6	...	...	£8 15 0 (W)
Do. do.	108	Sickle ...	do. do.	...	...	...	...	...	...	36.6	36.6	...	...	£8 15 0 (W)
Superphosphate ...	109	A.C.F. ...	do. do.	...	...	...	...	20.5	0.5	1.0	22.0	...	...	£10 0 3 (W)
NITROGEN PHOSPHORIC ACID AND POTASH.														
Potato Manure "E2"	106	C.S.M.L. ...	do. do.	...	3.5	...	...	11.5	1.25	1.25	14.0	8.0	...	£20 5 1 (W)
MISCELLANEOUS.														
No. 2 Fertiliser	105	Wooltana	Westralian Farmers Co-op., Ltd.	...	2.0	...	...	5.0	...	20.0	25.0	...	...	£10 0 0 (W), £14 5 0 (P)
ERRATUM.—The following fertilisers replace those shown under the same registered numbers in the December, 1950, issue.														
A.—MINERAL.														
1.—NITROGENOUS.														
(a) Nitrogen as Nitrate.														
Nitrate of Soda	102	Champion	R. Dundas Smith & Son	16.0	...	...	...	...	...	...	...	...	...	...
2.—PHOSPHATIC.														
(b) Superphosphate and Minors.														
Super and Zinc	10	C.S.M.L. ...	Cuning Smith & Mt. Lyell F.F., Ltd.	...	...	...	...	17.0	1.75	1.75	20.5	...	Zinc, 2.5	£10 19 3 (W)
Super and Manganese	11	do. ...	do. do.	...	...	...	...	15.0	1.75	1.75	18.5	...	...	£18 2 2 (W)
5.—NITROGEN, PHOSPHORIC ACID, AND POTASH.														
Potato Manure "A"	19	Mt. Lyell as ML in dia- mond	do. do.	...	2.5	...	...	14.0	1.5	1.5	17.0	...	5.0	£15 13 4 (W)
B.—ORGANIC.														
(d) Miscellaneous.														
Special Garden Fertiliser	38	Blue Cross	Agricultural Products, Co.	...	5.75	...	...	...	...	...	16.5	...	1.5	£23 4 5 (W), £23 14 5 (P)

